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January 13, 1958 75 cents

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—General Thomas J. Power, Commander in Chief, Strategic Air Command

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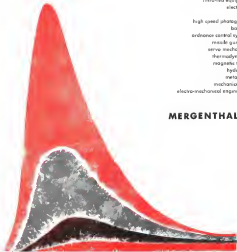
With its affiliate, Radiation Electronics Corporation, Mergenthaler is currently developing infra-red scanning systems for industrial, high altitude air-to-air and low altitude sea-to-ground applications.

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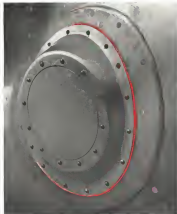
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Radial stress being located at top of Port Headstock. Commonly controlled by run equipment, it serves as a "Spring cushion" to absorb some manufacturing variability.

U. S. ARMY SIGNAL CORPS DEVELOPS ELECTRONICS FOR ATOMIC-AGE AT FORT HUACHUCA PROVING GROUND

Fast Forward, once a sleepy cavalry post, has come of age in the last few years. When the United States Army Electronic Proving Ground was established here in early 1954, this mile-high post was set upon a new trail marked by electron tubes, transistors, radar antennas, and television cameras.

Nestled against the base of the rugged Huachuca mountains about 300 miles north of Tucson, its 70,000-plus acres are a backdrop of electronic activity under United States Army Signal Corps direction. The many types of different levels are ideal for the testing of electronic equipment.

North 5,000 military personnel and approximately 2,000 civilian employees, many of them highly skilled scientists, are engaged in work at the Proving Ground.

The new look in defense is placing heavier burdens on the United States Army Signal Corps. Then, of course, remote mass communications with new devices tested for employment in atomic war. The Combat Development Department at the Proving Ground has been experimenting along these lines. A new system of battlefield communication designed to meet the threat of mass destruction from nuclear attack is now in the planning stage.

Meanwhile, the Signal Communications Department is conducting tests on both standard and exper-

mental United States Army Signal Corps equipment to determine their future work with the new look in defense. Under stress of attack, the use of extensive wires will not be practical. Many radio communications is the answer, but ways to get more channels on radio frequency must be found.

With the spread-out of troops under intense attack, increased surveillance of combat areas is a necessity. The Combat Surveillance Department of USAFPC is presently developing and testing a surveillance system with devices on the ground and in the air to bring reconnaissance and fire control information to the field commander.

Another important Proving Ground product is the "Flying Canaan." A high speed camera is mounted in the fuselage of a remote-controlled drone aircraft. The aircraft is launched into the air by means of jet boost. When its mission is completed, the drone parachutes to the ground and the signal launching unit. Its up-to-the-minute pictures are developed, and the troops proceed to hit the pre-posted areas of resistance.

These are just a few of the many projects under way at Fort Hanscom, helping to keep our country's military offense and defense the world's best.



Engineers at Ford have used sleek, but strong, cast-iron axles for United States Army contract.

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B.F. Goodrich Rivnuts® help fasten electronic "ears" that track orbits of man-made moons



Rivnuts provide sturdy blind nutplates for ultra-sensitive equipment that will receive radio impulses from Vanguard Satellite



During the International Geophysical Year, scientists will launch the first American satellite, the Vanguard. To track its orbit around the earth, Mustang antennas in North and South America will receive radio signals from the satellite itself, compare them with other antenna receivers, and relay position information to the Vanguard Computing Center in Washington.

The photograph (left) shows the inside of a Mustang section, with the receiver rack as the center. Fastening the free parts of the rack posed a problem for Bendix Radio Division, manufacturers of the equipment. Because the frame is made of square tubular aluminum for greatest strength, ordinary nuts and bolts could not do the job.

Bendix found the answer in B.F. Goodrich Rivnuts, which provided sturdy, blind nutplates, easy and economical to install. Whatever you manufacture, from complex electronic equipment to simple steel metal assemblies, B.F. Goodrich Rivnuts may be the answer to your own peaking fastening problems.

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EDITORIAL

Aviation's 1958 Scoreboard

Congress last week opened its most significant session since World War II. It is now crystal clear to almost every citizen and legislator that the United States faces the most serious challenge to its existence since the birth of the republic. It is pretty generally recognized that maintaining the political, economic and military strength required for national survival in face of the Soviet challenge demands new thinking, vigorous action and emergency confidence in the human and natural resources of this nation.

After several years of complacent hope that the specter of Soviet omnipotence would vanish like a nightmare at dawn, even the political leaders of the present Administration are reluctantly beginning to admit that we face a formidable adversary. Whether this belief in the Administration has grown strong enough to provide the decisive leadership the situation requires will be one of the major issues debated by the nearest Congress and by the American people whose future is at stake. In this session of Congress, aviation will be one of the dominant issues. The whole defense picture hinges on the scope and pace at which aeronautical technology, with its related fields of aerospace, propulsion and electronics, will be permitted to operate by political and fiscal actions of the Congress and the executive branch of the government.

In this area some of the critical points to watch for in keeping score are:

- **What will happen to the research and development budget?** Will it go along at about the same level of the past three years with perhaps a token increase that will be eaten quickly by the rising cost level? Or will it get the major increase that is required, perhaps doubling or tripling present levels? And will it get the wholehearted support of the Postings and White House or just a lip-service endorsement that will do little to accelerate or expand this critical activity?

- **What will happen to the major advanced weapons projects** such as the Wand missile defense system, the hypersonic glide bomber, and manned space vehicles? Will they be pushed boldly, backed by technical and financial resources commensurate with the tasks involved or will they suffer from further stagnation, grow slowly in advisory committee meetings and be budgeted and audited to death.

- **What will happen to the ballistic missile program** that now often promises a relatively quick payoff in new

operational weapons? Will it be pushed to the full limit of our industrial and military capacity to build these weapons and put them into service? Or will these programs be continued "on schedule" to fit a pre-Sputnik schedule that had no element of urgency in its drafting?

- **What will happen to the major production cutbacks and stretchouts for conventional weapons** needed so badly to modernize the current generation of our forces in being? Will these Whitman cutbacks stand as that these weapons will not be fully operational in the inventory until the 1960s when a new generation should really be taking their place? Or will they be speeded up to modernize Strategic Air Command, Air Defense Command and the Navy's carrier based striking power and anti-submarine strength as soon as it is technically possible?

- **What will happen to the air logistics system** so vital for Army, Navy and Air Force to function in the air of atomic warfare when other logistic pipelines are too slow and too vulnerable? Will we continue to develop and produce weapons without any modern logistic support for their combat operations? Or will we develop a modern gas turbine powered air logistics system that can meet the requirements of future military operations?

Civil aviation is a vital part of the total aerospace picture. Here are some of the key issues to watch:

- **Will the modernized defense program** be vitally needed both by military and civil aviation be studied to provide money for the military aerospace program? Or will the government continue full support of the program designed to end the situation that is already lowering the growth of commercial aviation and reducing the efficiency of military aerospace deployment?

- **Will the airline law problem be resolved?** Will the Civil Aeronautics Board, led by Congress and the executive branch of the government, face up to its responsibility in developing a jet age transport system or will it lapse into a legislative rat-packing administration of airline rules and regulations?

- **Will Congress deal with the international air transport situation?** Will it stop the State Department's give away program of U.S. air rights to solve its foreign policy problems? Or will the trend toward turning U.S. domestic traffic rights over to foreign airlines continue unchecked?

These are some of the issues to watch to see what happens to aviation and the future of this country in this year of decision.

—Robert Hays

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Consider these three important facts!

- 1 Kidde's Continuous Strip Fire Detector, first of its kind on the market, has been proven successful by more than seven years of intensive flight experience on both military and commercial aircraft.
- 2 As a result, the majority of U. S. commercial transport manufacturers and air lines already using continuous strip fire detection have chosen the Kidde system.
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Let Kidde's unrivaled experience in the field of aircraft fire detection help solve your safety problems. Write today for facts on the advantages of the Kidde system... the continuous strip fire detector proven in flight!

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In the Front Office

Mr. Rank, president, International Air Lines System, Inc., Air Ranch, succeeds Boeing, Thomas Holt, retired.

George F. Clapham, vice president and director of military operations, Fairchild Lessor & Leasing Corp., Hagerstown, Md. F. E. Newbold, Jr., succeeds Mr. Clapham as vice president and general manager of Fairchild Leasing Division, Deer Park, N. Y.

Frederic J. Spenser, senior vice president, Raytheon Manufacturing Co., Waltham, Mass.

William H. Davis, Jr., executive vice president, and William J. Finkelman, director vice president, Alconair Inc., Corp., Detroit, Mich.

Richard A. Miller, vice president engineering, Hudson Laboratories, Inc., Los Angeles, Calif.

L. George Harrison, vice president and John A. Reckling's Sons Corp., East St. N. J.

Mr. Cline, Frank E. Stuart (USA, ret.), succeeds in the president, Veeva Aero Inc., Palo Alto, Calif.

Honors and Elections

Whitney G. Collins, president of Northrup Aircraft, Inc., has been elected president of the Los Angeles Post of the American Ordnance Association.

The Society of Automotive Engineers, Inc., has announced the following late appointments representing professional activities for 1955: C. M. Christensen, director of flight safety, United States Army Air Corps; H. W. Holsinger, assistant manager, Aerospace Systems, Santa Ana, Calif.; division of General Corp.-aerodynamics; C. E. Mann, chief, engineering services, Veeva Division, General Motors Corp.-aerodynamics.

Changes

Frank Gluck, military aircraft engineer, Suncoast Corporation in Division Washington, D. C., first instruments, Inc., Dallas, Tex.

Lawrence S. Fisher, director research and development, International Rectifier Corp., El Segundo, Calif.

Richard S. Bland, manager of operations, Veeva Division, General Motors Corp., Detroit, Mich.

Herbert L. Schmitt, Midwest regional sales manager, General Instruments Division, Emerson Radio & Phonograph Corp., St. Louis, Mo.

John M. Kowale, service manager, Aero Radiative Service Center, Victoria, Inc., Detroit, Mich.

A. E. Talbot, west coast representative, Ken Ageloff, Contract and Defense Production Division, French & Lomb Optical Co., Rochester, N. Y.

Mr. Gen. E. B. McChesney (USAF, ret.) will join the American Ordnance Association, Washington, D. C.

A. J. Zelman, Jr., director of engineering, Electro-Tec Corp., South Hackensack, N. J.

INDUSTRY OBSERVER

Watch for USAF to announce a major production contract for the Corvair B-55 supersonic jet bomber. Decision to put B-55 into production beyond test quantity of 50 now on order has been made by USAF's Air Council with strong support from Strategic Air Command.

Boeing Aircraft and North American's Rockwell's Division are stilling long small scale turbine rocket motor. In combination with auxiliary jet streamtunnel classified turbine, the hybrid turbine offers a specific impulse above 300, or better than a 25% increase in performance over present gas-turbine combustors. Full scale production models of turbine engine are still due in five years time. Lack of space suitable for liquid turbine engine is one of the major drawbacks. The large amount of liquid needed for further development is another.

Aerospaces Development Corp., Santa Barbara, Calif., a subsidiary of GenCorp-Wright Corp., is proposing to the Defense Department several turbofan engines and test system using today's off-the-shelf hardware. Some obvious would have the capability of lifting the engine with payloads of 2,000 lb or better.

Person planning early first flight of North American X-15 high altitude research vehicle in January, 1959. First flight will be glide test only, with constant flight scheduled to begin three months later. Defense Research Division of National Advisory Committee for Aeronautics already has made several proposals to the Department of Defense for sending the X-15 into orbit as a manned vehicle.

Air Force has approved delivery of Learning 155 turbine powerplant to Bell for installation into the Y14-40 helicopter for reaction tests although the engine has not yet passed an initial 150 lb. qualification test.

Air Force is approaching helicopter manufacturers on the feasibility of using living cranes for hoisted movement of automobile engine, turbine engine, their cranes and supports. Deconstructed cranes would be transported in pods.

East German plant now working on the native-designed Rostok/Rosin turbojet transport (AW No. 4, p. 41) is also reportedly developing a medium-range turbojet transport, to be designated the R-153. First model of the R-153, to be built in both 40 and 70 seat configuration, is scheduled for completion in May.

Lockheed F-104 has successfully passed spin tests carried out by the company for USAF. Aircraft equipped with spin skirts was stalled 35 times at altitudes of between 16,000 and 20,000 ft and held in spin. F-104 also failed to spin unless pilot failed to execute the maneuver while coming out of a turn and during room entries and an accelerated entry. In a total of 30 tries, the aircraft was spun eight times by coupling deliberate stalls with a combination of spin skirts. Pilot recovered from these without use of the spin chute.

Although both Atlas and Titan intercontinental ballistic missiles use three engines, Atlas is described as a two-and-a-half stage missile and Titan as a two-stage. All three Atlas engines are fired on the ground. Two boosters drop off in flight. Titan's two boosters are ignited on the ground, drop off after sustainer engine is ignited in flight.

Radio Corp. of America has received a sizable Air Force contract for the development of an intercontinental ballistic missile early warning network, presently exploring radar.

Convair is investigating the use of newer turbine alloy for use in turbine mounts and turbine under an Air Force study contract. Convair is being specifically asked to determine the adaptability of the new alloy to the design, fabrication and construction of turbine engine systems. Contract total is \$61,368,044.



Picture of above shows new Kennedy and Dr. V. Stewart Center now under construction in Wilmington, Massachusetts. Scheduled for completion this year, the experimental laboratory will house the scientific and technical staff of the Aero Research and Advanced Development Division.

Science and Progress at Avco—1957

Truly significant discoveries and technical progress are the goals of the Avco Research and Advanced Development Division. Some of the Avco RAD record of accomplishments are contained in professional papers in scientific and technical journals. Much of it is classified for reasons of military security. But the following public announcements serve to outline some of the steps taken by RAD—the "Breakthrough" Division of Avco—in pursuing its goal for 1957:

- February 15, 1957** Site Prepared for Avco RAD Center
- April 5, 1957** Avco to Make Hypersonic Shock Tubes for Industry, Universities, Other Research Groups
- July 1, 1957** Avco to Develop New Radio Back Set for Marine Corps
- July 9, 1957** Prime \$11.1 Million Contract Awarded for Development by Avco of New Core for Intercontinental Ballistic Missile
- August 26, 1957** Avco Shock Tube Research's New Produced Throatless Breakthrough on 5000 Mile Air Force Ballistic Missile
- November 22, 1957** Tany "Building Blocks" Revolutionize Computer Design and Construction
- December 3, 1957** Avco to Build Air Force Control Computer

Avco's record during the past year is significant from scientific, technical and business points of view. It has been made possible by sustained effort at RAD to maintain an atmosphere conducive to creative thinking and production of the highest order.

AVCO
Research & Advanced Development

Avco's new research division now offers unusual and exciting career opportunities for exceptionally qualified and forward-looking scientists and engineers.

Write to Dr. B. W. Johnston, Scientific and Technical Relations, Aero Research and Advanced Development Division, 30 Rock Union Street, Lawrence, Massachusetts.

Washington Roundup

More Power for Haladay

Continuation of responsibility by William M. Haladay, Pentagon director of guided missiles, in continuing work the transfer of new authority and control promised to his office from the office of the Assistant Secretary of Defense for Research and Engineering. Under the new arrangement Haladay will have four areas of activity:

- Air Defense Missiles, headed by Dr. W. Peterson former director of guided missiles in the office of the Assistant Secretary.
 - Tactical missiles, headed by E. J. Switzer.
 - Strategic missiles, headed by John W. Klits.
 - Exotics, headed by R. J. Coffey.
- Reorganization probably will be announced at Capitol Hill, where congressional critics have been demanding more evidence that Haladay has excessive power and will act it.

East-West Exchange?

Watch for public announcement of greatly negotiated talks between the U. S. and Russia on the possibility of exchanging both cultural and technical information and personnel. Exchange would include such fields as metallurgy, chemistry and physics. The talks were initiated by Eisenhower after an exchange of notes during the war. U. S. negotiator is State Department Ambassador William Lacey. Russia is represented by Ambassador Gennep N. Zorubova.

Science Attaches Revived

State Department, prodded by Congress and Russia, is finally working to re-establish its science attaché program designed to provide professional liaison posts in other countries where scientific developments may be worth reporting. There is \$200,000 in the current budget for the work and a few "reflected" candidates are being sent to take a top job as science attaché. Once the work is started, special envoys will be sent to France, West Germany, Sweden, Japan and India.

Scientific Education

Democrat leadership in Congress wants to go farther than the Administration in aid to scientific education. Legislation planned by Sen. Lyndon B. Johnson (D-Ala.), chairman of the Senate Labor and Public Welfare Committee, and Rep. Carl Albert (D-Ala.), chairman of a House Education and Labor Subcommittee, would provide 140,000 scholarships over a six-year period at \$1,000 a year. Of these, 75% would be for study of science, engineering, mathematics and languages. The Administration plan contemplates 10,000 scholarships a year for four years, a total 40,000 (AW Jan. 6, p. 25). In addition, the Hill-Elliott proposal would provide \$35 million for matching grants to states for the construction of science teaching facilities.

Congressional Investigations

This major congressional investigation got under way this week.

- House Armed Services Committee headed by Rep. Carl Vinson (D-Ga.) begins its investigation of the defense program and the organization of the defense establishment.

next Friday. Vinson, like his counterpart, Sen. Richard Russell (D-Ga.), chairman of the Senate Armed Services Committee, is opposed to proposal to replace the Joint Chiefs of Staff with a single chief of staff.

- House Government Operations Committee headed by Rep. William Dawson (D-Ill.) begins an inquiry into all federal research and development programs Jan. 17 (AW Dec. 2, p. 25). First witnesses will be Dr. Detlev Bronk, president of the National Academy of Sciences, and Alan T. Waterman, director of the National Science Foundation.

All Chiefs, No Indians

Rep. Charles B. Brown (R-Ill.) last week submitted a proposal designed to prevent the erosion from service of such men as Arthur L. Geis, James Glavin, Aron, deputy chief of staff for research and development (see page 35). Brown's plan "A crash program" to make men Brown said, "no soldier, men will ever again be exempted to take his command and go home because of a shortage of staff."

Navy the Richest

Richest branch of the Armed Forces in terms of aid program, the Navy with \$26.6 billion worth of goods ordered around the world. USA's second with \$23.9 billion and Army, fourth with \$18.3 billion. Defense Department total at the end of the last fiscal year was up more than 50 billion over previous count of total assets, equipment and other holdings. Most of the increase is attributed to jet aircraft, modernization of the fleet and initial outlays of Avco's ships in Korea.

Engine Profits

Rep. Edward Hebert (D-Ala.), chairman of the House Armed Services Investigating Subcommittee, says he expects to hold hearings on the profits and procurement practices of aircraft engine manufacturers this winter. But the outlook is that the investigation will be quickly dropped. The subcommittee required 17 manufacturers to submit extensive data last year.

The charge against Curtis Wright Corp. that the firm was using its own facilities for the production of government facilities used in commercial production was dropped by General Accounting Office (AW Dec. 18, p. 57). Last week the subcommittee proposed a public hearing on the case. It is being conducted by the Armed Services Board of Contract Appeals.

Jet Symposium for Senators

Members of the Senate Interstate and Foreign Commerce Committee Aviation Subcommittee headed by Senator A. S. Mike Monroney were given a quick, but comprehensive view of the planning last week that is going into the commercial jetliner transition from piston engines to jet aircraft. The symposium was presented by Air Transport Association, Trans World Airlines, Pan American World Airways, Eastern Air Lines, United Air Lines and American Airlines. Sen. Monroney and the subcommittee would be made into a Senate document to aid in future airport planning.

—Washington staff

Air Force R&D Faces Extensive Review

Reorientation, shift in emphasis in USAF projects are expected to result from Stever committee study.

By David Clark

Washington—Most extensive review of USAF's research and development activities since the Air Research and Development Command was created in 1945 is now being conducted by an ad hoc committee appointed by Gen. Thomas D. White, Chief of Staff.

Expected result is a reorientation of all USAF research efforts to shift the emphasis still further from the current generation of manned subsonic weapons to missiles and spacecraft.

Recommendations also will deal with shifting changing concepts of strategy, most of which have been modified continually but have not had a major overhaul in approximately a decade.

The committee, known formally as the Air Force Research and Development Committee, informally is called the Stever committee, and is headed by Dr. Conrad Stever, executive director of engineering at Massachusetts Institute of Technology, and former Air Force Chief Scientist. Dr. Stever also is vice chairman of USAF's Scientific Advisory Board and chairman of other ad hoc Air Force committees.

Named Chairman

National Academic Committee on Aerospace also has named Dr. Stever chairman of its new Special Committee on Space Technology (see here, page 29).

The Stever committee is being convened on the civilian group, organized in 1949 and headed by Dr. James Rahnert, whose studies resulted in the creation of the Air Force office of Deputy Chief of Staff for Development and of the Air Research and Development Command.

Dr. Stever's group is examining all aspects of USAF's research work, including organization of the Deputy Chief of Staff ARDC, the advisory board's relationship with Air Materiel Command and current and future requirements of operating agencies such as Air Defense and Strategic Air Command.

Recommendations may be made by each group. Other members are:

- **Bruce Ackerman**, president of the Stever-Warner Corp.
- **Dr. W. R. Lovell**, Jr., Lovell Foundation for Medical Educational Research.
- **Dr. Clifford T. Morgan**, private consultant in psychology.
- **Prof. Courtland D. Probst**, Deputy

chief of Aeronautical Engineering at Princeton University and former USAF Chief Scientist.

• **Paul W. Pratt**, assistant engineering manager Pratt & Whitney Turbine Division United Aircraft Corp.

• **Dean Ralph A. Stevens**, University of Virginia School of Graduate Studies.

• **Dr. T. F. Wallance**, Engineer's Research Association.

Evaluation Scope

Committee was created last November but assignment of its members was only last week. Its charter calls for it to evaluate Air Force organization, functions, policies and procedures as they relate to research and development, and make recommendations as to which could lead to increased effectiveness.

Committee began work last Nov. 21 and already has voted a number of

efforts and various ARDC centers. Stever group's study approach is said to be more comprehensive than an evaluation of ARDC's structure (AW Sept. 16, p. 28) which was aimed at possible streamlining both to increase effectiveness and to meet stringent cost-cutting efforts then in effect.

In addition to the Stever committee's work, ARDC itself has been going considerably, such as recent revision to its organizational structure and its role in the overall defense system.

ARDC then has made one change which is more radical in nature, change in name, from an organizational mechanism that reflects both the continuing role in technological emphasis and the rapidly changing political climate of the past few months. The Directorate of Aeronautics under the Deputy Chief of Staff for Research and Development has been replaced last Dec. 16 by the Directorate of Aeronautics and the Directorate of Astronautics Division has become the Flight Mechanics Division.



Honeyey stood on ground to turn off measuring light will be checked on behavior in space.

Cornell Probes Weightlessness

Studies of how to investigate the effects of man's subliminal functions is applied to physiological reactions during weightless space flight in which satellites or other space vehicles have been undertaken at Cornell Aeronautical Laboratory, Dept. for Air Research and Development Command.

Under a contract with the Space Biology Branch of ARDC's Holloman Air Force Medical Development Center, Cornell is working on a study to deter-

mine what type of experiments on man made in space capsules might parallel the best data on human reactions during a state of weightlessness.

Monkey and Rat

Cornell first decided what animals to use in the experiments—monkeys and rats were selected—then an animal care manual experiments that would parallel the desired data and which could be practically performed in the

Stapp to WADC

Washington—Col. John P. Stapp, Chief of the Air Force Missile Development Center's Ames Research Field Laboratory at Holloman AFB, N. M., will soon be transferred to Wright Air Development Center, Dayton, Ohio, to lead the Ames Research Laboratory there.

Col. Stapp is a pioneer in human tolerance under shock tests and also succeeded in research. His transfer at Holloman dates back to the time when the field laboratory at Holloman was known as the Space Biophysics Field Laboratory. He will replace Col. Jack Bell, head of WADC.

conduct of a space capsule and under the weightlessness inherent in space experimentation.

Laboratory techniques covered on and experiments which could be expected to detect disturbances or signs of disorientation and maladaptation during exposure to weightlessness.

The monkey and rat would be exposed to the experiments for only a few minutes and then returned safely to Earth by parachute.

Plus of the experiments is to train both animals to respond to certain stimuli on the ground, then subject them to the same stimuli under a state of weightlessness and see if their responses were in any way affected by weightlessness.

Monkey Is More Complex

The monkey's experiment will be more complex than the rat's. It would be strapped into the capsule with its arms attached to levers which it can move either to the right or to the left. Inside the capsule, it will be faced at the monkey will be two light-red and green—which will be lighted up at random to indicate a cue which the monkey had previously learned on the ground.

The monkey, in order to respond, because decision behavior, will be trained on the ground to behave in a manner known as "double-response discrimination." This will teach him that he must respond the disturbance of the lights by moving the right lever to the right and the left lever to the left. This is a negative drive.

The rat will be subjected to "self-stimulation" in order to correlate human decision behavior. Example is to have the rat repeatedly perform a specific response which is followed by a pleasant sensation. This is a positive drive.

Positive and Negative

Cornell recommended use of self-stimulation technique for the rat and the positive procedure for the monkey to provide an indication of the effects of



Photo Shows Details of Atlas

New Air Force photo shows in Atlas details. Note nose/angle attack indicator on lower protruding from nose, most nose cone, facing (left) possible for electrical counter, nose, vital pipe (lower left) one of the power generator packages mounted by engine and black lines with antenna package above.

ness of both positive and negative drives during simplification. The differences between the two models themselves also may prove of help in interpreting results. Both animals would occupy the same capsule.

Whether and to what degree the animals can adapt their known capacities to respond to known stimulation during a nightmare that is the prime question.

Behavior of both animals will be recorded by motion picture cameras as well as by electroencephalogram.

Work on this project is being done by the Human Factors Section of the Laboratory's Vehicle Dynamics Department in consultation with Professor B. Richard Beggall, Psychology Department, University of British Columbia.

Hobbs Will Retire From United Aircraft

East Hartford, Conn.-based S. Hobbs will retire on April 1 from his position as vice chairman of United Aircraft Corp. after 50 years of service with the company and its predecessor. He will continue on the board of directors and on the executive committee.

Hobbs, whose retirement was announced at the company's annual stockholders meeting, was awarded the Collier Trophy in 1935 for development of the J57 jet engine. He also was instrumental in the development of Pratt & Whitney's line of piston engines, including the R-1600 Double

Wing and the R-4600 Wing Major. His last year of the original Pratt & Whitney Aircraft Company in 1917 as a research engineer. He was elected vice chairman of United in 1956 and has been a director of the corporation since 1947.

Beech MS-760 Price Quoted at \$210,000

Wichita-Beech Aircraft Corp. will market the French MS-760 executive jet transport for a package price of \$210,000, considerably less than the \$300,000 tentatively quoted when Beech was demonstrating the MS-760 here in 1975.

Package price is for a complete standard airplane including paint and upholstery. It also includes a small number of spares, ground handling equipment, optional beds and a room heater. Training course fee also are charged.

Under its factoring sales program Beech will stock spare engines and parts in Wichita (AW Dec. 9, 1975, p. 114) and the company said it can deliver them anywhere in the U.S. or Canada in one day. Replacement engines will be available here in one hour, Beech says.

Beech is selling the MS-760 under letters from Maurice Skolnikoff, Co. The last plane from engine jet will be shipped from France and assembled in

More Polaris Money

Washington—Approximately \$47 million more in Fiscal 1976 funds will be put into the Navy's Polaris fleet that had lost missile systems, Lockheed Aircraft Corp. and last week.

Lockheed's Missile Systems Division is systems manager and developer of Polaris. The new funds will bring the total Navy investment in Polaris to \$135 million. Navy considers the 1,390 missiles as its primary weapon system and is accelerating it again, partly as a result of recent Soviet Perestroika moves giving submarines more leverage.

Lockheed's original contract was for \$20.5 million. Last October Navy announced a \$82.3 million Fiscal 1975 contract for modernization.

New York, East plane will be delivered in June and will be used as a demonstrator. Second unit, scheduled for July delivery, has been sold to Taiwan Rofair Rong Co. (AW Dec. 2, 1975, p. 95).

Beech will sell the MS-760 with U.S. built engines, and the aircraft's value will be guaranteed. Some work is being set at 25,000 H under Civil Aeronautics Regulations Part 3.

French jet is powered by two Turbomeca Marboré IIC engines, each rated at 883 hp thrust. Gross weight is 7,775 lb. MS-760 will cruise at 593 mph, has a top speed of 603 mph and a range of about 1,000 miles.



MOCKUP of Army Jupiter intermediate range ballistic missile recently was exhibited at Chicago Auto Show in Chicago International Amphitheater. Missiles were said to be continuously deployed by actual missile, demonstrating were reported to be 651 ft. long, weigh 167 tons in launch. Estimated cost a short four feet in diameter. Note Jupiter ground handling crane and railcar.

Chrysler Gets Order For Jupiter Parts

Washington—Chrysler Corp., Warren, Mich., has been awarded a \$10 million contract for components and ground-support equipment for the Jupiter intermediate range ballistic missile.

The Army developed weapon will be operated by the Air Force, along with its own Douglas-Thor IRBM. The Defense Department made the money available for the Jupiter procurement program during the remaining months of Fiscal 1955.

Another \$21.8 million in contracts was awarded to Chrysler for continued production of the Army Redstone missile now produced at the Warren facility.

Brig Gen John A. Barlow, deputy commanding general of the Army Ballistic Missile Agency, Huntsville, Ala., recently said the deployment date for Jupiter was the fall of 1955. The 60th deployment as being Jupiter in Europe, complete with support equipment and troops trained to use the missile.

The cost of Jupiter on a production basis would be in the neighborhood of \$1 million each without launch, Barlow said.

Chrysler is expected to double its present 4,700 person employment here at the Van Dyke Road, Detroit, missile plant, which is reported to be operating at about 75% capacity on Redstone production. Tooling plans are said to be well advanced. Estimates indicate that Jupiter production in Detroit will reach four to five a month by the end of the year.

NACA Space Group

Washington—Establishment of a special committee on space technology headed by Dr. H. Gervais Brown, former chief scientist of the Air Force, was announced last week by the National Advisory Committee for Aeronautics.

The special committee, which will help coordinate NACA's work towards space flight, will have approximately 15 members. Dr. James H. Doolittle, NACA chairman and the organization should be completed within the month. Dr. Doolittle said such committee members "will be a leader in some aspect of the broad field."

Dr. Henry, now associate dean of engineering at Massachusetts Institute of Technology, served as head USAF scientist in 1951-56. He also is vice chairman of the Scientific Advisory Board of the Chief of Staff, USAF.

Missile Divisions Begin Organization

Inglwood, Calif.—Strategic Air Command's Missile Division, Cooke AFB, Calif., which will have responsibilities for achieving operational capabilities of intercontinental ballistic missile systems and ensuring of its intermediate range ballistic missile units for current operations, has been placed under the command of Maj. Gen. David Wolfe.

First Thor IRBM squadron—the 47th—already has been formed and headquartered at Cooke AFB under the command of Col. Harry J. Zook, former SAC project officer for Thor at Air Research and Development Command's 8th Air Force Division, Peterson AFB, Colo. new number about 1,000, but these are much longer-range troops.

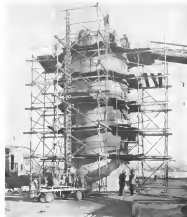
First Jupiter IRBM squadron—the 56th—is scheduled for activation on Jan. 15 and will be commanded by USAF Col. William C. Edwards, former command of the depot crew member for plans and operations at the Ballistic Missile Division. Initially, Air Force personnel for Jupiter squadron will come at Army's Redstone Arsenal in Huntsville, Ala. No direct on Jupiter has yet been received here.

Training at Cooke AFB contracts.



Egyptians Display Soviet-Built Aircraft

Egyptian Air Force today publicly display at Abnasa Airfield included (left) two MiG-15 fighters, (center) an all-weather equipped MiG-17, MiG-19, MiG-21, MiG-23 advanced trainer, and two Czech Zlin 226. Tall training plane at lower right is apparently first of an F-14 transport. Aconewy was also marked by MiG-19s in major circles.



Polaris Launching Pod

Launching vehicle or pod under construction for Polaris test work probably is similar to equipment the Navy will use for its intermediate range ballistic missile from under the water. After its release from a submarine, the pod's ballast tanks would control its depth and keep it floating upright in the water. Equipment in the pod would be remotely controlled from a parent submarine located near defense area. Engineers also have been busy with making the Polaris pod structure so they could be used like launchers to test launchers. The transporting submarine could then load the vehicle and send any more shots against the launching area. Firing tests have been held at Westinghouse Electric Corp. and its launchers in waters of Ft. Belvoir, near St. Louis. Navy Shipyards, Groton, Conn., designer and builder of vehicle, expects to complete it by end of this month.

will include firing of ballistic missiles including the ICBM. Gen. Thomas S. Power, SAC command, would not reveal the number of ICBMs to be allocated to each operational squadron.

Gen. Power said no plans have yet been made to introduce the Northern Star intermediate-range ballistic missile into the Cooke AFB squadron and he would not say when that would become an operational mode.

Gen. Power emphasized that armed aircraft had a definite place in SAC's future, commenting that missiles and bombers will supplement each other.

He said these are no plans now to assemble intermediate-range ballistic missiles in Western Europe and they

would then be flying to the missile launchers from the Cooke would be over a Pacific Ocean area. Gen. Bernard A. Schriever, Ballistic Missile Division Commander, said this would not be a research and development step, but only for testing flight. It will be led out in clouds with Navy's Ft. Meigs station for developing instrumentation. There are no external Major stage to accommodate, except for out into the Pacific beyond the distance of Alaska.

An A-100 (renewal) will be built at Cooke for longer support of the base. Gen. Schriever said. Of the 30,000 acres at Cooke, 50,000 will be for Air Force. Balance will be used by Navy. Air extension of Ft. Meigs activities

Pratt & Whitney Gives Schmickrath New Post

East Hartford, Conn.—Bernard A. Schmickrath has been named assistant engineering manager of the Pratt & Whitney Division of United Aircraft Corp. from his former position as general manager of the division's nuclear engine program since last October.

The nuclear engine program at the Connecticut Aircraft Division Engine Laboratory in Middletown will be assigned into the division's overall engineering program rather than continuing as a separate operation.

Schmickrath will retain prime responsibility for the program, and Charles E. Hallinger, chief engineer at Middletown, will remain as resident head of the program.

The program will continue at the present level under Atomic Energy Commission sponsorship. Air Force studies on the status of the support unit studies are in the midst of design, expected, author's (AW Aug. 15, 1957, p. 34).

Three Marks Claimed For Army Helicopter

Washington—Three new world altitude records for helicopters are being claimed by Army for the Sikorski YH-10. Series powered by a 178 hp Continental 195-170 piston engine.

The four-place helicopter, flown by Capt. James E. Brennan of the Army Aviation Board, Ft. Rucker, Ala. flew to 18,175 ft. in two equal categories—1,000 to 2,300 ft. and 2,300 ft. to 18,175 ft. in a new height category, 2,300 ft. to 18,175 ft. The helicopter reached 17,200 ft.

All three records are subject to confirmation by the Federation Aeronautique Internationale.

Previous altitude records in the restricted weight and 1,000 to 2,300 ft. class were 15,951 ft. established by Jean Bédard of France in an S E. Aéroplane on June 6, 1955.

Symposium Concludes Reliability Goal Closer

Washington—It is goal of obtaining reliable military electronic equipment is closer but not much closer to attainment than before, according to speakers at the Frankford Reliability Symposium on Reliability and Quality Control here.

Problems being discussed range from production of components capable of operating for 10,000 to 100,000 hours under normal, continuous duty conditions to techniques for long-term, complex equipment, such as the SAC, are

from a few hours, operating for more than a few years.

One conclusion of industry studies is that in the future, a manufacturer's past performance in maintaining high standards of reliability must become increasing attention.

Another is that procedures should be developed for developing equipment with poor records of performance from military manufacturers.

Results of an Air Force study to determine reliability of electronic equipment now in use were presented by Lt. Col. J. S. Lambert of Air Research and Development Command.

The study indicated several families of equipment and not to determine reliability in terms of the length of time that such type could be expected to operate before failing. The results showed:

- AN/GRC-27. Mean time to failure of the AN/GRC-27 communications receiver was found to be 393 hours.
- AN/FP-3. Mean time to failure for the AN/FP-3 long-range radar was found to be 74 hours.
- AN/ARQ-4. Mean time to failure of the AN/ARQ-4 radar system was found to be 10 hours.

The most complex system studied for reliability to date is the AN/FSQ-7 computer used in SACI (Semi-Automatic Command and Control) system. The computer system 18,000 electronic tubes, 178,000 diodes, 147,800 resistors and 104,000 capacitors.

Techniques used to obtain maximum reliability have included:

- Component development. Special component designed for extreme long service life have been developed.
- Environmental control. Failures have been reduced by controlling both temperature and humidity throughout the equipment.

Test procedures. Test programs have been established and are run on a regular schedule in an effort to anticipate and guard against failures.

In general terms, Col. Lambert and the Air Force reliability program can be divided into three phases: (1) to achieve the state of the art, (2) to achieve all of specifications to include reliability, (3) to ensure that the highest quality components are used in construction of USAF equipment.

A two year study by Armstrong-Rohde Inc. compared the reliability of electronic equipment maintained by military operators with equipment maintained by civilian operators. The study showed that the reliability of both operators was the same, but that military operators need more than 10% more components in averaging (repair).

The conclusion of the ARINC study is that military operators, even those with the most training, appear to have more on a full-time basis, replacing one component after another in order of likelihood until the equipment repairs again.

The 50% waste was found to be present.

Congress Reconvenes, Begins Push To Provide More Defense Money

Washington—Congress reconvened last week and promptly began its push for more programs and money for defense and defense.

House Appropriations Subcommittee on the Armed Services Committee began consideration of the Administration's supplemental request for \$1.1 billion in new fiscal 1958 funds providing for:

- Construction of dispersal and first facilities for the Strategic Air Command—\$179 million.
- Establishment of a ballistic missile defense system—\$129 million.
- Development and procurement of language ballistic missiles and the construction of missile sites and ballistic missile submarines—\$681 million.
- Semi-Automatic Ground Environment Systems—\$29 million.

Establishment of the Advanced Research Projects Agency under the Security of Defense—\$10 million (see page 30).

Defense Reorganization

Washington—President Eisenhower told Congress last week he will soon propose some reorganization of the defense establishment in an effort to streamline and save money.

Eisenhower said no details but indicated that some powers would be vested with the Secretary of Defense, including a change toward the single command, he said, "is a basic reorganization of the military services to achieve coordinated effort."

In his last of three messages the President and the Administration's fiscal 1958 budget requests for defense, science and education will be about \$4 billion above that asked in fiscal 1957.

Despite increased defense expenditures the President said he still hopes to balance the budget by "reducing expenditures on less essential military programs and installations, postponing start new civilian projects (including more to the states and matching or financing them).

Defense projects scheduled to arrive annual emphasis in fiscal 1959, the President said, include:

- Army mobile weapon system.
- Expansion and dispersal of Strategic Air Command and Navy striking forces.
- Long-range missile program and other effective missile systems.
- More advanced aircraft.
- New submarine and missile.
- Improved intercontinental weapons.
- All weapons types of mobile force to deal with local conflicts.

The President also called for increases in military pay and incentives and a "big" and "big" research and development program. He said he will ask "for action" to be taken in basic science fields, including a doubling of the funds available to the National Science Foundation for this purpose.

Johnson Pushes for Control of Space

Washington—Adopting the theme that control of space will mean control of the world, Senate majority leader Lyndon Johnson (D-Tex.) said last week the present Congress is faced with "a work that will occupy and dominate the Congresses of this men for life time to come."

Defense and foreign policy, he said, will dominate the nation, and "the problem of propulsion will be the major factor in legislative activity," Johnson said.

Reveals Findings

Remembering the findings of his Task Force Investigating Submarine Warfare before a conference of all Democratic senators, Johnson said the general health of the nation is not as good as it has been, largely except arms, and "the human side, itself—without regard to flight or philosophy—has multiplied its capabilities to infinity."

The exploitation of these capabilities by men of selfish purpose holds the awful threat of a world in subjugation," Johnson said. "The masters of such capabilities by men selfishly dedicated to further selfishly interest, the conquest of a world at last liberated from human, liberated in fact from fear of war."

Then he, the subcommittee has heard 34 witnesses and conducted 150 to 200 staff interviews with scientists, government officials, industrial leaders, scientists, engineers and educators.

Industry interests tentatively scheduled to testify are:

- Donald Douglas, Sr., chairman of the board of Douglas Aircraft Co.
- William N. Allen, president of Boeing Aerospace Co.
- Ben P. Hurley, chairman and president of General Wright Corp.
- George M. Barden, chairman of the board and president of the Martin Co.
- Walter C. Collins, president of Northrop Aircraft, Inc.
- Thos. Kindahl, president of Aerojet-General Corp.
- W. H. Riedelberger, chief executive officer of North American Aviation, Inc.
- T. G. Langford, Jr., vice president of Convair Division, General Dynamics Corp.
- Robert E. Gross, chief executive of Lockheed Aircraft Corp.
- Lawrence Hybrid, Hughes Aircraft Division Hughes Tool Co.
- Marvin E. Kelly, president Bell Telephone Laboratories.
- Gen. David Sarnell, chairman of the board Radio Corp. of America.

White Hits Budget

Other developments:

- Gen. Thomas D. White, USAF Chief of Staff, told the subcommittee the Administration had rejected his "every plan before even paper airplanes" for acceleration of the Atlas and Titan intercontinental missile programs. Nevertheless, the subcommittee budget request for the 1963-1964 budget provided enough ICBM funds, Gen. White said. Some acceleration at Atlas was included, but no increase at all in the Titan pro-

Sputnik Rewards

Moscow—Russia has poured out money and honorary rewards to personnel and organizations which played leading roles in building and launching the Soviet Union's first Earth satellite.

A large group of scientists, designers and "experts" has been given Lenin medals. The title of Hero of Socialist Labor was conferred on personnel who built the *Sputniks*, the rocket motor, the launching cranes and the measuring and control equipment. Orders of merit were awarded to research institutions which took part in designing and launching the *Sputniks*.

Announcement was also made of a decision to concentrate the launching of the first Earth satellite by using an orbital in Moscow.

grain was provided for by Gen. Gen. White said USAF is "generally not getting enough material benefits, just enough for the moment."

• Lt. Gen. James M. Gavin, Army deputy chief of staff for research and development, told the subcommittee he is resigning after 10 years' service because he can get nothing done about what he termed the rapidly deteriorating position of the Army. Gavin said that when he came to Washington four years ago the Army had 37 divisions and a \$12.6 billion budget. Now it has 15 divisions and its \$8.6 billion budget. He advocated an "optimum Army of 25 divisions to meet" one challenge after another "under the auspices of the space age."

Promotion Issues

Earlier, Johnson had quoted Gavin as saying that Army Chief of Staff, Gen. Maxwell Taylor, called him in 30 days after his first assignment before the subcommittee and told him he was no longer being considered for a promotion. Gavin later claimed the promotion offered him demand and told he was quite ready to turn down the promotion, which he said he had already declined the July 1959 badge.

Despite firing by the subcommittee and Army Secretary Wilber M. Bricker, Gavin said he has been on his retirement a long time.

• Rep. John H. Rarab, D-R.I., told the subcommittee the most factor in the success of his atomic submarine project was a general feeling that he would fail so he was left alone. Rarab, once criticized the lack of money people believed in, is that which have no responsibility, lack of sense of urgency among top research officials and red tape and endless conferences. He said

he is afraid that it is almost too late to match Soviet achievements. Rarab also said he recommended a morale submarine two years ago but "the subcommittee" buried it alone.

Barke Disputes Rukover

Adm. Adolph Barke, Chief of Naval Operations, said the subcommittee designed to carry the *Polaris* fleet ballistic missile were not built earlier because it was not certain then that the missile could be perfected.

Adm. Barke also said Navy will develop its atomic airplane "in the next couple of years." It will be a low speed, subsonic surface plane. (State's Ministry of Supply said the Navy has approached it on the possibility of making a 16-year, 100,000 flying hour, low speed, subsonic, a modified aircraft carrier).

Barke also took strong issue with the growing criticism for more continued activity.

Objecting to "a military solution," Barke said possession of this also leads to "its almost inevitable conclusion—abolishing Congress and making the people's elected chief executive a figurehead and place on the floor of a single cabinet, National Executive."

Barke also said Navy will keep on other atomic carrier in this year's budget in order to get more and submarine surface equipment and said he expects Polaris to be ahead steps by 1963.

Navy Atom Plane Plan Disputed by Rep. Price

Washington—Joint Congressional Atomic Energy Committee is determined to block Navy plan for an atomic-powered airplane, proposed by Chief of Naval Operations Adm. Adolph Barke.

Rep. Melvin Price (D-Ill.), chairman of the Atomic Subcommittee on Research and Development, and the chief of the Navy, said he will delay the Air Force's atomic carrier propulsion program for "at least three or four months" while the Navy's proposal is reviewed and evaluated.

He said USAF's atomic carrier program is based on a "crisis" state which, he estimated, would allow for a reasonably good, atomic-powered aircraft could be flying within two years.

The program will have been approved by the Department of Defense and the White House. Price said.

"The Navy, which up until the present time has showed little interest in the nuclear aircraft program, now seems to take interest in the Air Force's large part of the subcommittee responsibility for aircraft and engine development. As a result of its interest in aircraft and equipping it



Douglas, Brucker inspect Thor

Air Force Secretary James H. Douglas and Army Secretary Wilbur M. Brucker inspect the Thor missile. The missile is a large, cylindrical object with a complex structure, and the men are standing next to it, looking at it intently.

between the Air Force and Navy on this matter, the project has now again been thrown into a whirlpool of discussion and confusion, with the prospect of no atomic thrust, group being set up to achieve the right between the Air Force and Navy.

This project to produce a nuclear airplane has almost literally been studied to death over the years of its existence. At last night, I think there have been no less than six or seven expert panels and committees who have reviewed the project from time to time, some of them concurrently.

"What this program needs is action, not another study group."

To the conclusion, the Navy should continue its important studies directed toward possible nuclear use for a nuclear aircraft.

Uping that USAF be given the "go ahead" for its acceleration plan, Price commented.

"We need atomic aircraft and we need it now as the aircraft nuclear propulsion program. It is a safe bet that decisions on the objectives are being far and on the ocean, we are in peril in meeting those objectives."

Kefauver Favors Jupiter

Washington—Sen. Estes Kefauver (D-Tenn.), second ranking Democrat on the Senate Subcommittee Investigating Submarine Warfare, favors the Army's Jupiter inter-continental missile instead of a space weapon but is skeptical of the Air Force's Thor.

During a conference of Democratic senators last week on military goals before the subcommittee, he said, Kefauver said he believes "the Army's guidance and money system is superior and even doubtless this course covered in the Thor-Amy guidance system is lighter" so as to make possible a long payload. Kefauver said.

"The Air Force is committed to heavy, expensive, detachable remote launching," Kefauver said. "The Army, on the other hand, is ready to place its guidance on the ground, so we may launch it by plane or truck." Air Force witnesses have insisted that they do not need Jupiter and have endorsed the Army's lack of weapon system concept and lack of supporting equipment (AWD, Dec. 25, p. 20).

Kefauver also said it is controlled that Army's usual system, it appeared to USAF's military system, "tests had time very substantially," he said, "all the groups and people who make a great in making decisions" in one place.

"There is a serious question, Kefauver said, "as to whether the sea and land of Jupiter should be taken away from the individual and society who have developed it and have found it successfully and placed with another society who undoubtedly has a greater far than one developed the Thor."

"The question has been raised as to whether under these circumstances, the Air Force would really sell out of the Jupiter."

Defense Secretary Neil McMillen may be considering the decision to produce both weapons (AWD, Dec. 18, p. 16).

Two Anti-Collision Systems Proposed

One plan using infrared, another using weather radars, are submitted to the Air Transport Assn.

Los Angeles—Two new types of airborne collision warning systems are being released by the Air Transport Association meeting on the air collision problem.

•McDonnell-Hawcroft proposes a dual-mode infrared system. In one mode of operation, the proposed Hawcroft system would go beyond proximity warning and indicate which aircraft are actual collision threats—pending until aircraft are equipped with small radar and beacon. Regarding the ATA's preference for non-cooperative systems, Hawcroft says its system could function as a proximity warning indicator, similar to the one being developed by Avionics General, against aircraft not equipped with beacons.

•Federal Telecommunications Laboratories proposes a non-cooperative system which uses interferometric techniques in combination with existing radars able to provide collision warning against aircraft in the forward quadrant. Avionics General, which regularly pleads to demonstrate its infrared proximity warning indicator to the ATA group, deferred the demonstration be-

cause of unexpected installation problems which have delayed the program. Both objectives have wings and more intricate fused. Arrangements to meet its 160-day release schedule from the top of the backlog of program's DC 3 to top of current schedule. The infrared backing up the current schedule for non-cooperative beacons.

Two flight hours were being made with only moderate successful performance. Because of minor bugs, such as more electrical interference, according to Avionics General's Richard W. Powell. However, none of the results to date has shown Avionics' faith in the ability of its system to meet original schedule of performance. Powell says (AW Aug 12, 1957, p. 77).

Hawcroft Proposal

Hawcroft's Dr. John B. Hatcher says the addition of a low-cost infrared beacon on aircraft offers a number of significant advantages over a non-cooperative infrared system. These include:

•**Clearer images.** Aircraft equipped with infrared sensors can detect an infrared beacon equipped aircraft, ac-

countless of type, speed or report angle at sufficient distance to provide at least 20 sec warning time required for evasive maneuvering. Non-cooperative infrared system provides 20 sec warning only under certain conditions and report angle, less under others.

•**Calculus warning.** If infrared beacon is designed to flash off and on at a rate proportional to airplane's magnetic heading, this added information enables systems equipped with a detector, whether or not the intruder is a collision threat and adequate warning "beacon" from nearby aircraft that are not a collision hazard.

Hawcroft anticipates that a complete system, to be successful, depends upon widespread implementation by aircraft users, therefore hopes that the infrared beacons for light planes can be placed in the range of \$100,000 per unit. As now conceived, two beacons necessary: one mounted in the rear of the aircraft, the other high on the nose and tail of each aircraft. Small equipment non-power demand would be used to indicate beacon. Hawcroft says to indicate appropriate display heading.

Avionics, military and large business aircraft would be equipped with two beacons plus an infrared sensor and associated collision warning computer circuitry. When an infrared signal from

another aircraft is detected, computer will analyze relative magnetic headings of two aircraft and relative bearing between two aircraft to determine whether a collision threat exists.

Hawcroft has conducted limited flight test evaluation of techniques proposed for the new collision warning system. Dr. Hatcher says.

Federal Proposal

Federal Telecommunications Laboratories proposed is an outgrowth of both systems developed for aircraft problems.

A Federal aviation indicated that in these weather radar could provide some of the collision problem. Data such as ground contours, such as distance to a tower and rate of change of distance. However, weather radar does not provide data on intruder bearing with sufficient accuracy to provide rate of change of bearing information to the computer needed for collision threat computation, according to Federal's Ben Alexander.

Luckall therefore proposes to employ interferometric techniques to obtain rate of change of intruder bearing. This involves the installation of four small antennas in the nose of the airplane and associated circuitry, which measures the relative phase of radio energy which is scattered off the intruder by the airplane's weather radar.

By a suitable combination of information on rate of change of intruder bearing obtained from the latter plus intruder speed and altitude obtained from the intruder's radar, Federal says it can determine accurately whether the intruder poses a collision threat.

Federal proposes to use a three inch cathode-ray tube panel indicator which will display, under direct control, which are likely to come within 1,000 ft. of collision. System will calculate and display a small arrow on the panel indicator which shows direction of maneuver necessary to avoid collision. Length of the arrow will be a rough indication of the seriousness of the threat, according to Alexander.

System Limitations

Alexander acknowledges that the proposed system is limited to coverage in the forward quadrant but says that accident statistics indicate that this is the most usual collision zone. System also is fundamentally limited to a useful range which is less than an airplane's altitude above ground because of ground reflections. Then for an airplane flying at 10,000 ft., the useful range would be approximately six miles but would drop to less than a mile for an aircraft flying at 5,000 ft.

Federal system is expected to weigh approximately 60 lb. installed and cost about the same as a weather radar—around \$10,000.



707-320 Wing Panel

Wing panel of first Boeing 707-320 is being removed from it. This long-range 707 version will be delivered to Pan American World Airways, which will select 15. Panel is among list of 707-320 components to come off assembly line.

Bristol-Hawker Form Company for BEA Jet

London-Bristol European Airways is expected to announce its contractual order for some 70 new short-range jet aircraft (AW Jan 6, p. 43) sometime this week.

Bristol 200 design to be built by a joint company set up by Bristol Aeroplane Co. and the Hawker Siddeley Group, wanted to have an edge over government pressure. BEA is believed to have indicated the de Havilland 121 proposal.

This difference between BEA, on one side and the Transport and Ministry of Supply on the other has delayed announcement of the contract for months.

A deal meeting on the decision is scheduled between Lord Douglas, chairman of the independent airline and Hawker Siddeley, Minister of Transport and Civil Aviation. Announcement of the order will follow this meeting.

Hawker Siddeley and Bristol have announced that Sir Arnold Hall, director of the Hawker Siddeley Group, will be managing director of the new company with Dr. A. F. Russell, designer of the Britannia airliner, as chief engineer.

The firm will be based mainly at Hawker Siddeley and Bristol in a 15/55 proportion.

The new company will be backed by the combined financial resources of the

Joint company

Panel changes in specifications have resulted in a 600-plus mph. aircraft which will have a gross thrust weight of approximately 120,000 lb. and be designed primarily for short-range operation.

Dr. Hatcher's design calls for Rolls-Royce RB 141 engines, a small version of the Compressor engine.

An announcement by Hawker Siddeley and Bristol says the Bristol 200 will "have more powerplants in its arsenal in the cockpit." Both Bristol Olympus engines and Rolls-Royce engines are provided for in the Bristol design but BEA prefers the Rolls-Royce powerplant version.

Bristol will be responsible for installation including various hydraulics and conditioning devices, engine proofing and handling. Hawker Siddeley will be responsible for the structure, including wing, semi-cabin, control and fuel tank.

Full use will be made of special subcontractors and suppliers of production equipment.

BEA is believed to be making a last-minute plea in favor of the de Havilland proposal but most observers here doubt that the government will change its stand in favor of the Bristol 200, which it favors due to the adaptation of Hawker Siddeley and Bristol. In view of public statements on the issue, it would place the government in an extremely embarrassing position politically if it should join up the Bristol-Hawker proposition.



Vapor Trails Farm Pattern Over London Airport

Vapor trails create a pattern as the winter day above London Airport at dusk. Control tower is in the middle, control terminal and bus stop visible on the left.

Polar Route Competition Tempo Rises

By Glenn Garrison

New York-Buffalo, for example on the West Coast Express polar route is starting down, at a hot market which has been the exclusive preserve of Scandinavian Airlines for the past three years.

Having inaugurated their polar service during the end-of-year month of September 1957 Pan American World Airways and Trans World Airlines are achieving fairly good head factors on the route. So far at least SAS says it is holding its own.

When peak-season schedules go into effect next April, the battle will be joined in force. Meanwhile, member airlines are—Alf P. Anderson, editor of *Aviation*—beginning to fight for rights to the market and few other airlines can enter it without their choice.

Competitive Positions

A head-on fight will see the polar competition as follows:

• TWA has an advantage over both Pan American and SAS—the Lockheed 14-40 Constellation which can often fly the route nonstop and then provide the fastest service. Trans World also has a company lead over PanAm in the fact that passengers in the rear

third of TWA's flying continued. • Pan American is allowing greater freedom to TWA, thus giving the latter a strategic future position. • SAS has been identified for three years as the polar airline has pioneered the service throughout its career.

The Scandinavian carrier now provides only Los Angeles-Copenhagen service on the route. Although it is seeking rights at San Francisco-TWA flies from San Francisco and Los Angeles, Seattle and Portland on the West Coast. London and Paris on the European end.

Five Schedules Weekly

SAS presently has five scheduled weekly in each direction to Pan American's four and TWA's two, but Pan American will match SAS in April when each carrier operates eight weekly roundtrips. TWA will go to four flights at that time.

With Pan American in first with the most air in the American carrier's fleet, continued, TWA can claim the first in arrival times. Its long-range jet—down south by nonstop and often can make it well-timed with other airlines. The airline can't actually schedule its coast-bound flights as nonstop, but doesn't lose the possibilities.



Northeast's Executive Lineup

New Northeast Airlines President James W. Austin (center) shortly arrives in Boston to take over the job. Austin is former vice president of Capital Airlines. With him is Robert E. Fry (right), American Airlines vice president at Capital, who will serve Northeast as vice president of sales and sales. At left is George Gifford, Northeast president who becomes board chairman and continues to evaluate the office.

Figures for TWA's operation through last November on the polar route show eight roundtrips per week, with a total of the airline's Los Angeles-London flights. Weekdays, that week-day flight also serves San Francisco and made it to that city morning from Los Angeles (and out of Los Angeles) before it would have a 19 hr., 10 min. combined 21 hr., 35 min. combined.

Best time so far on the nonstop flight, according to TWA, was 16 hr., 14 min. from London to Los Angeles.

Current's other polar flight, Los Angeles-San Francisco-Panama and on to Rome, occasionally flies the segment between San Francisco and Panama without a stop. Scheduled time for this flight between Paris and Los Angeles is 19 hr., 45 min. combined, 22 hr., 5 min. combined.

TWA plots its polar flights over minimum time routes worked out by a world airline unit at New York International Airport. Average minimum time track, Los Angeles-London, the airline says, is about 17 hr., 30 min., and actual time has often come close to this, although sometimes within a minute.

TWA's other polar flight, Los Angeles-London, the airline says, is about 17 hr., 30 min., and actual time has often come close to this, although sometimes within a minute. The other flight, which carried about 40 passengers combined and combined, flew London-Los Angeles last week.

PanAm Patterns

Pan American operates some of its DC-7Cs polar schedules in what seems to be the most strategic pattern. Two of its four weekly combined flights originate at San Francisco in south about 24 hours and three-quarters to Los Angeles and depart northwest from Los Angeles for Europe, usually with a fuel stop at Teterboro, N.J. Before it leads. A third flight is named Los Angeles-San Francisco-London and the fourth flight serves San Francisco-Portland-Boston-London.

The double-track of San Francisco-originating flights serving Los Angeles of course provides Los Angeles passengers with a better service. Instead of waiting out a landing and taking again from San Francisco, the passengers avoid a stop at that city altogether. Los Angeles is by far the larger market and the San Francisco passengers get the direct service on the flight that goes Los Angeles-San Francisco-London. Scheduled times of Pan American's combined polar flights range from 21 hr., 35 min. Los Angeles-San Francisco-

London to 22 hr., 35 min. San Francisco-Los Angeles-Panama. Weekdays, schedules range from 21 hr., 35 min. Los Angeles-San Francisco-Los Angeles to 24 hr., 40 min. Pan Am Los Angeles-San Francisco. All schedules include a stop at Teterboro of 45 min., although about 10 min. are sometimes used for the fuel stop because of unexplained considerations.

Pan American is flying all mixed DC-7C flights, with capacity varying as to composition of each class sold.

SAS, now operating one all first class and four second-class flights in its

DC-7Cs, postponed the polar route in 1954 and had carried 68,110 passengers by the end of its third year of operation last Nov. 15. During that time the Scandinavian carrier flew 246.5 million secure passenger miles on the route in 1,778 flights.

Scheduled time in SAS's planes is 20 hr., 10 min. combined, 25 hr. combined. Its combination aircraft provide 34 tourist seats, 12 standard first class and eight sleeper seats and a lounge. First class configuration is eight sleepers, 12 first class and 12 "dormitory" seats, plus lounge.

Despite the new competition, "we're doing very nicely on the polar market," Western E. Kinnear, SAS' president and sales and sales told *Aviation*. Western Kinnear and it's said to judge the effect of Pan American's and TWA's entry into the market, because it hasn't been felt yet.

"Now the parade begins," Kinnear commented. SAS' last letters on the route have averaged 75% in both first class, and have yet shown no signs of tapering off.

Kinnear feels that the greatest future potential of the polar route lies in selling

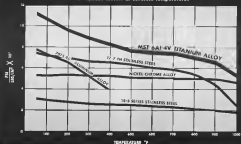


Continental's First Viscount Flies

Continental Airlines' first Viscount 820 produced by Vickers Armstrong made its initial flight from Weybridge airport. Flying the aircraft was Capt. R. Rogers. The first deliveries of Continental's 18 Viscounts are expected in early spring. Modifications to aircraft patterns are underway changes before initial delivery is made. New propeller tip speed between engine in both planes.



SHORT-TIME STRENGTH-TO-DENSITY RATIOS for various metals at different temperatures



TITANIUM ON TOP in medium-high temperature range

Today's most popular titanium alloy, MST 6Al-4V, exceeds all other metals in strength to density ratio through 800°F. At room temperature, considering only strength, a part made of this alloy need have only 80% of the weight of the equivalent part in stainless steel.

Performance for extended times at elevated temperatures is likewise good. In typical creep tests, with 1% permanent deformation allowed, MST 6Al-4V alloy shows 100,000 psi allowable stress at 700°F for 1 hour; 71,000 psi at 100 hours; 68,000 psi at 1000 hours.

Meanwhile new alloys extending the elevated temperature usefulness of titanium—in as high as 1000°F—are now emerging from the laboratory into production.

Write Dept. B-1 for copy of "Titanium Alloy Properties"

SELECTION GUIDE TO MST ALLOYS

Typical Mechanical Properties of Annealed Titanium and its Alloys

| | Form | Yield Strength, ksi | Tensile Strength, ksi | Elongation, % |
|-----------------------------------|-----------|---------------------|-----------------------|---------------|
| COMMERCIALLY PURE TITANIUM | | | | |
| MST Grade 2 | Sheet, 36 | 70,000 | 84,000 | 24 |
| | Sheet, 36 | 70,000 | 84,000 | 24 |
| | Sheet, 36 | 70,000 | 84,000 | 24 |
| TITANIUM ALLOYS | | | | |
| MST 6Al-4V | | | | |
| Annealed | Bar | 100,000 | 120,000 | 12 |
| Age hardened (350° F) | Bar | 120,000 | 140,000 | 10 |
| Age hardened (400° F) | Bar | 120,000 | 140,000 | 10 |
| Annealed | Sheet | 100,000 | 120,000 | 12 |
| MST 7Al-3Cu | Bar | 120,000 | 140,000 | 12 |
| MST 7Al-3Cu | Bar | 120,000 | 140,000 | 12 |
| MST 7Al-3Cu | Bar | 120,000 | 140,000 | 12 |
| MST 7Al-3Cu | | | | |
| (1) 700° F (2) 700° F (3) 700° F | Bar | 120,000 | 140,000 | 12 |
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MALLORY SHARON
MALLORY SHARON TITANIUM CORPORATION, BOSTON, MASS.

Producers of titanium and titanium alloy sheet, strip, plate, rod, bar, billets

it not only to West Coast passengers but as a national and international basis for a joint gateway with the East Coast airport. Considerable SAS investment comes from funders who combine a close U.S. tie with a pole to Europe, either leaving or arriving at the East Coast to complete the circuit. SAS has been developing this market and has been selling tickets to its office, such as South America, for years. Knausner said. Then if Pan American and TWA make requests to the West Coast originating business, SAS will continue to top other markets.

There has been no evidence, according to Knausner, of efforts by the American airlines to build the route on a national basis. Negotiations involving SAS's request for San Francisco probably will begin

again later this month, Knausner said. The airline is "very, very interested" in strong that city, and numerous it would need some incentives to whether Pan American would be allowed to bring its initial pole flights into Paris.

Civil Aeronautics Board, which last July turned Presidential approval of its westward extension of the West Coast American and TWA, was optimistic about the market potential.

The 79,000-passenger annual traffic attributed to Pan American in the 1917 westward extension of the West Coast Europe market was supported by the Board of being "economically attractive." Transatlantic passenger traffic from the West Coast, the Board estimated at a 1917 level, is growing more than either TWA (20%) or Pan American (25%) forecast.

Schedule Rule Attacked as 'Unworkable'

By L.L. Davis

though it did have and against on Sept. 26, 1956.

American also and the draft release differed from the final ruling and called the adoption of the regulation a "surprise" since almost one year had elapsed since the agreement on the draft release was filed.

Chief Objections

Here are the chief objections to the regulation:

- **Responsibility of airline performance.** American said in its petition for reconsideration that it "is physically impossible" for an airline to operate its aircraft on a tight schedule. It is a "practical impossibility" for an airline to operate its aircraft on a tight schedule. It is a "practical impossibility" for an airline to operate its aircraft on a tight schedule. It is a "practical impossibility" for an airline to operate its aircraft on a tight schedule.
- **Industry agreement on schedules.** American said the regulation has driven progress the current had made towards an industry agreement which would have improved the industry problem.
- **Regulation would.** American charged that the regulation exceeds the Board's power under the Civil Aeronautics Act to compel airlines to operate on a tight schedule. It is a "practical impossibility" for an airline to operate its aircraft on a tight schedule. It is a "practical impossibility" for an airline to operate its aircraft on a tight schedule.

Ruling's Verdict

The continued ruling it charged to tighten scheduling practices of the airlines by making it a criminal offense to fail to operate flights within 15 minutes of published schedules at least 75% of the time in any three calendar months. The ruling was adopted last

August following the issuance of a CAB draft release in April, 1956.

AFA has charged that the ruling, a new part of the Board's common agreement is unfairly designed to restrict from the agreed draft release. It said that because of the complexity of the issues raised in the draft release the Board was requested to conduct a full evidentiary hearing on the subject and

Then the Board declined to do so.

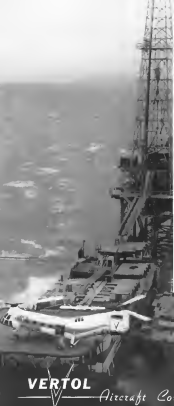
Full within 15 minutes of scheduled times on 75% of the flights on each separate schedule. The ruling also applies to all flight segments. American pointed out that this part of the ruling suggests that each separate flight must operate within the 75% rule but that terminal-to-terminal operations could violate the rule.

For example, operation on each segment of a five-segment schedule could be five minutes above the published time—total within the 15-minute tolerance—but the total operation on a terminal-to-terminal basis would be 25 minutes behind scheduled time. Application of regulation to terminal-to-terminal flights is a "practical impossibility" for an airline to operate its aircraft on a tight schedule. It is a "practical impossibility" for an airline to operate its aircraft on a tight schedule. It is a "practical impossibility" for an airline to operate its aircraft on a tight schedule.

'Good Faith Information'

In its petition, American charged that the problem involved in the case is that of ensuring that the traveling public is given information as to the probable arrival and departure times of aircraft which is reasonably accurate and not misleading when the particular conditions imposed by the weather, operating conditions of the aircraft, etc., are taken into account.

It added that the airline industry gives the public "good faith information" as to when the airlines are "at least" to operate flights. American said that the airlines operate on a tight schedule and that the airlines operate on a tight schedule and that the airlines operate on a tight schedule and that the airlines operate on a tight schedule.



Vertol 44 flies 19 passengers or 2 tons of cargo to offshore rigs

Carry 19 hefty passengers (300 pounds each) in cozy comfort 40 miles out and 40 miles back—or 12 passengers 187 miles out and 187 miles back—in your Vertol 44, and you'll still have fuel reserves for 30 minutes of cruising flight. Waterwing hullage construction and new lightweight titanium gear assure you of the highest standard of safety.

Vertol's tandem rotor design provides a 50% longer than any other commercial helicopter. This means more passengers or more weight on every flight. Because of the forward sliding forces, you have no load placement problems with the Vertol 44. Since you can do away with hoisting and time lost in precise order of priority suspensions.

When loading and transport is a problem, have your gear, pumps, compressors, motors and rig segments by Vertol 44. As a flying crane it holds bulky or odd-shaped items suspended beneath the fuselage in safety or good-carrying rigging.

The Vertol 44 Work Horse may be the safest and most economical tool you need to offshore or exploring operations. Details available on request to:

Customer Relations Manager
Vertol Aircraft Corporation
Morton, Pennsylvania

Vertol new design exhibits safe operation from lift-off, take-off, autorotation and landing and in gear. Note slushproof skid gear by Sikorski skid.

VERTOL

Aircraft Corporation

MORTON, PENNSYLVANIA

government cannot require any flight activity to meet the time published in schedules.

"The airline and government regulations cannot deal with problems of performance."

It added that, even though the specific number of scheduled flights are prohibited by the airlines, "it is an understatement that it means that the answer is performance, but the aircraft will depart or arrive at approximately that time."

The airline admitted that it would often be possible to predict arrivals and departures with a high degree of accuracy if the positions were made in accordance prior to each departure. It said, however, that schedules are published long in advance because the public needs to know upcoming times, days and which route is available.

The Air Transport Association wanted an action for noncompliance that the airlines, agencies and representatives of the regulation would have some control to adjust a rule of self-type of scheduling or a system where schedules could be included not to accommodate the shortest type of trip.

In such cases, the ATA and airlines would stand opposed to all their own people, since the rule would be that the regulation "shall not be construed as interfering schedules or plans as to conduct, management or efficient management."

Hughes Stock Plan Proposed by Examiner

Washington—Subcommittee of investigating for stock held by Howard Hughes in the Atlas Corp. to govern possible dual control of Trans World Airlines and Northeast Airlines has been recommended by the American Bar End Examiner Paul N. Pfeffer.

If the initial decision is approved by the Board, subcommittee of the Department of Justice will be brought to a close.

In his conclusions, Pfeffer said that the subcommittee must strengthen the proposed voting trust procedure, would be an order requiring Hughes to sell his Atlas shares.

"Psychological impact on Wall Street of the disposal of Hughes holdings concerning 10% of the outstanding Atlas stock, could cause losses to those holders of small Atlas stockholders."

If the recommendation is accepted by the Board, Hughes would be permitted to retain his stock in Atlas which holds a 10% interest in Northeast, but a trust, designated by the Board, would take the stock. Hughes controls 77.4% of TWA stock, through his Hughes Trust interests.

Tipton Outlines Airline Proposal To Curb Operation of MATS

By Ford Estess

Washington—Stuart G. Tipton, Air Transport Association president, presented a new proposal today for a schedule and route authority that would place the position of U.S. airlines and hold national defense aircraft rights.

In testimony before the Subcommittee on Military Operations, the House Government Operations Committee, Tipton said airlines should receive a much greater share of traffic now carried by the Military Air Transport Service. This, he said, would provide the first action to be taken to reduce and increase their fleet which, in turn, would increase the nation's ability to carry heavier loads than is possible. As John F. Dole, independent Airlines Association, executive director, on behalf of the nation's congressional caucus.

Following a Tipton's proposal, which is effect calls for all military traffic to be carried by civil air.

• **Military surface mail requirement** should be determined by the Defense Department.

• **Warfare requirement** for civil commercial operations both domestic and international, should be determined by the Civil Aeronautics Board or its chairman after consultation with the State Department.

• **Above two requirements** should be coordinated and held civil air carrier capability measured against the combined national surface requirement subtracting the total civil capability from the total national requirement, he said.

• **Military aircraft** in sufficient quantity to meet the deficit should be retained by the Air Force.

• **Passenger military** and requirements should be determined by the Defense Department and forward to the State Department for review.

• **Civil or commercial airlines** should be permitted to carry this traffic, or its own aircraft—either in common carriage on the scheduled routes or by contract.

• **If the procedure** followed in the above steps results in all of the passenger, mail, and cargo being carried by the military, service by MATS transport fleet should be maintained in a condition of constant readiness.

• **If the procedure** leaves some of the military passenger requirement unmet, the Air Force should maintain a suitable number of the MATS fleet for

lease to agencies for the specific purpose of non-military traffic.

• **In the event** that these procedures fail to produce sufficient lift for the passenger military requirement, the Air Force could undertake a business program or operate scheduled trips, passenger service with its own equipment.

The defense program suggested by the Air Force is supported by both major groups in Washington. Under this program, civil airlines would transport MATS traffic with MATS equipment.

Dole said the Air Force in action should receive not more than 40% of the passengers and 25% of the cargo carried by MATS. This had been suggested earlier by the Senate Appropriations Committee.

Dole also proposed the creation of the position of a War Transport Administrator.

He said:

"We are frankly alarmed that there is no such agency in being at this time. No commercial agency of the type a country knows what will be expected of him as an emergency. Although the military services have no idea what will happen to their domestic traffic in the event of a crisis."

The hearings will continue this week with a session from the Commerce Department, CAB Areas, News and Air Force, scheduled to begin.

Challenge by Aerojet

Washington—Air Transport Association President Stuart G. Tipton would not back that Aerojet, the Texas state-owned airline is viable proposal to challenge the monopoly of U.S. domestic and international long-range carriers. Aerojet's long-range planning in the field was reported by Aerojet World on July 9, 1958 (page 26).

Tipton told the House Government Operations Subcommittee on Military Affairs that an effective means to curb transport operations in such the Soviet Union is holding will provide the most effective military strength, since the critical economic development and military operations procedure. He said it also will serve as a reliable but political substance and act as an effective propaganda weapon.

The 480 jet and turbo-propellers on offer by U.S. airlines Tipton said will provide an annual output of an estimated \$4 billion, two million passengers by 1961. Under military emergency conditions he said, the fleet could provide more than four million passengers of which more than

a step
beyond
push-button
warfare!

TALOS



The RCA Talos tracking from the RCA Defense System on Dec. 12, 1957, tracked in about 10 sec. defense driver plane.

The RCA Talos Defense System is the first completely automatic land-based system for searching and guiding missiles, and strikes the Talos Missile developed by the Applied Physics Laboratory and produced by Bendix. The Defense Unit receives target signals from remote outposts, analyzes them with regard to number of attitudes, location, course and speed. Next, computers determine the logical points of interception, order the missile locked on launchers, guide them at supersonic speed to the vicinity of the target, after

which the missiles "lock" on the target and close to for its destruction. All without even the touch of a button! The RCA Talos Defense System, with its electronic equipment and guidance systems, was designed, developed and built by RCA as prime contractor, aided by many subcontractors. It was turned over to the U. S. Army on October 13, 1957, and is a reliable milestone, exemplifying the continuing development of American technology to secure peace with honor and justice.



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SHORTLINES

► **American Airlines** has added new nightflight service between Philadelphia and Los Angeles using Douglas DC-4s. Scheduled Philadelphia to Los Angeles is 9:35 A. M. EST Monday through Saturday, with stops in Norfolk, Boston and Chicago. Arrival in Los Angeles is scheduled for 12:10 P. M. PST. The return flight will leave on 11:10 P. M. PST departure stopping at St. Louis, Chicago and Cincinnati and arriving at Philadelphia at 8:35 P. M. EST.

► **Continental Air Lines** will receive its credit and debit card began two and a half years ago. The airline was credit card holders have proved to be top credit risks with companies accounts showing less than 1% of past sales being delinquent or uncollectible. The Continental plan allows the traveler to place his reservations in the ticket agent and receive the tickets by mail.

► **North Central Airlines** closed 1957 by carrying 457 more passengers to December than during the same period of 1956. The airline carried 31,750 passengers during the month in comparison with 31,748 during December, 1956. The airline also flew 387,100 scheduled miles in December, an increase of 38% over December, 1956. North Central will celebrate 10 years of scheduled service on Feb. 24.

► **Chark Air Lines** set a new December passenger record for itself by flying 24,201 passengers. The new record is 11,651 passengers greater than the December high set in 1956 when Oshkosh carried 12,552 passengers.

► **South Atlantic** is planning a new \$2.7 million plant at its new facility, new Terminal to increase production of the Caracalla jet airline to a possible seven per month. The airplane for the new plant should be completed by the end of 1957—shortly after the first two airplanes Caracalla will add the monthly lines. The plant will be retrofitted into the main facility by mid-1958 when Caracalla will be coming off the production line. General orders for the Caracalla stand at 33, with options for an additional 33.

► **Trans-Canada Airlines** plans to construct a turbine engine research and maintenance base at Montreal's Dorval Airport. The new base will cost approximately \$20 million and contain 400,000 sq ft. The new store building will include an efficient hangar, a maintenance hangar, office and stock facilities.

AIRLINE OBSERVER

► **White House** support of Pan American World Airways' fight for traffic rights in Portland and Seattle on the transpacific Great Circle Route appear to have been rebuffed for the third time in three years by the Civil Aeronautics Board. Washington observers believe the Board has again refused its original recommendation that Pan Am be denied these rights in the Transpacific General Case because it did not seek a fourth two-carrier President Eisenhower approved the latest Board recommendation on Aug. 7 last on Sept. 3 announced that he would hold his first decision on transpacific advance and asked the Board to review its stand in the case on grounds of recent tariff increases between the U. S. and Japan. On his previous occasion, Eisenhower has reversed the Board's recommendations on Portland and Seattle traffic rights and each time he held the final decision in abeyance pending a CAB review.

► **Aviatic Australia National Airways** says it will purchase four Vickers Viscounts 610 turboprop transport aircraft from the U. S. The purchase will fly to London to complete the details of the transaction. The purchase will receive the delivery of these aircraft in the last quarter of 1958 and on in January, 1959.

► **French** between U. S. airlines and foreign carrier contracts to which deep-sea fishing in U. S. waters that the State Department has been studying in granting traffic rights to foreign operators. However, a number of foreign airline officials are charging that bilateral negotiations become bogged down and delayed because the U. S. has been too restrictive in opening U. S. routes to the foreign carriers. Latest split between France and the U. S. is on current bilateral talks (W. S. 4-11) and a second in a French announcement of the 1946 bilateral agreement between the two countries.

► **British Overseas Airways Corp.** is transpacific something out of its flights between London and the Far East while with new modifications are made on the air tables of its fleet of 15 Britannia 102 turboprop transport Modification program calls for a one-to-one removal of the aircraft from scheduled service.

► **Capital Airlines** has adopted a program designed to counteract effects of the long-term air as the cost of passenger personnel. The airline is conducting a continuing study to determine whether the where of the carriers has a damaging effect upon the learning of personnel assigned to areas within scope of the Viscount program. Meanwhile, the airline has moved employees to provide the service a western airline from the planes and an overall type of protection to people working close to the plane.

► **Rolling** permitting the exchange of air transportation for advertising goods and services by local service and regional airlines has been extended by the Civil Aeronautics Board until Jan. 3. A petition by the carriers through the Air Traffic Conference to expand the ruling to permit the use of transportation by contract stations sponsored by the advertiser was denied by the Board.

► **National Airlines** has been recommended by the Civil Aeronautics Board Council for the Buffalo-Miami route in lieu of Capital Airlines, originally recommended for the route. In November Bureau Council withdrew the Capital recommendation but explained that the Capital route could not meet the demands of public convenience and necessity should it be established within "a reasonably near future," that the airline could provide an adequate competitive service on the proposed route.

► **Watch** for mounting criticism in financial circles of Civil Aeronautics Board tariffs in exhibiting a need for a tax increase. Civil targets will be CAB except that passenger fares should be determined on the basis of net air fares as deposited such and the collection of capital gains on the sale of aircraft in determining fair earnings. Investment Bankers Association of America already has recommended that President Eisenhower support a highly qualified panel to review the Civil Aeronautics Act and CAB procedures.

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ROUGHNESS OF THE T58 engine design was proved by its exceptional performance under the severe accelerating and decelerating, stops and starts, loads and overloads. Official test results show:

- All required 35 starts exceeded specification guarantees. Typical acceleration time to idle speed bettered guarantee by over 40%.
- All engine throttle burst times were well within guarantee limits. Acceleration times from idle to 100% power were four times better than guarantee.

ADVANCED AERODYNAMIC DESIGN. Engine cut away at left shows the advanced design features that make possible the T58's exceptional performance and ruggedness... features that truly provide new levels of military and commercial usefulness for helicopters.

For more information about the T58 call your local G-E Aviation and Defense Industries Sales Office, or write General Electric Company, Section 333-15, Schenectady 5, N. Y.



T58 FLIGHT TEST PROGRAM began in January 1957 on Sikorski HO4S-1 (left), was recently extended to Vertol H-21D (center) and will include the Kaman H-43C (right). Comprehensive flight, rotor and cell tests have already proven the engine's performance, reliability, control stability and power splitting ability.

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AREA-BUILD FUSELAGE and control canards especially developed for this straight wings are incorporated in T-38 study models.

Light Turbojets Save Weight on T-38



INDIVIDUAL CANARDS and wheel-folds are fitted to both engines. They delayed meeting Northrop test pilots demonstrate better steps which already used for labors.

New turbo, of Pratt & Whitney General Electric high thrust-to-weight ratio turbojets provided Northrop Aircraft engineers with the leverage in planning their T-38 supersonic trainer as a design concept that would permit various capabilities equal to more conventional designs with major savings in development and procurement costs.

T-38 was developed as a result of parametric studies conducted during the summer of 1955 by Headquarters Air Research and Development Command for an experimental supersonic trainer to replace the Lockheed T-33. Northrop also bids that some of the criteria established for the T-38—high speed, maneuverability, production—will make the airplane attractive to dollar-short nations also. Compared to competing in a number of French foreign countries with a lightweight intercept version of the T-38, offering production license.

Cost Savings

Northrop points out that its studies of operating the T-38 and advantages of cutting comparable performance figures indicate that Air Force would save \$700 million in procurement, maintenance and operating costs in a five-year period, using 1,000 airplanes to conduct its basic training mission. Comparable airplanes, in various capacities,

belly would be roughly twice the cost and weight of the T-38, the company states.

In developing the T-38 design Northrop engineers gave maneuverability aspects special consideration in all primary aspects to the overall configuration and emphasized steps on an equal basis with performance, according to William L. Gosh, Chief Weapons Systems Development Engineer, Northrop Division, Hawthorne, Calif. Looking and manufacturing personnel were brought into the preliminary design stages to insure application of modern producibility methods to meet

Structural Detail

In 1958 objectives of minimum weight assurance are planned of machined and riveted aluminum welded skin, sandwich construction and elimination of conventional structural splices. Specified design criteria were examined critically to avoid unnecessary conservatism in loading inputs, stress factors and deflection requirements. In detail

Net weight was that the T-38 weighed in a 10,000-lb gross weight airplane,

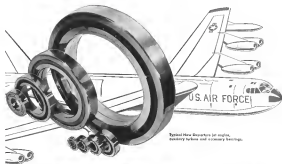


SHOWN ARE LOCATED side to side, in head off fuselage. All fuel is moved off of cockpit, permitting use of this area. Cockpit width is 30 in. before seat rail.



INSTRUCTOR SITS 10 in. higher than student. All controls and switches are located ahead of instructor's normal elbow position. Cow maneuvering, navigation and instrument landing system equipment remains as installed in most jets to get maximum and neglect through

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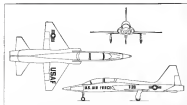
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with approximately 5,000 lb. consisting of turbine weight. If a conventional design approach had been followed, using a single large thrust turbojet in place of the lightweight engines, the airplane would have weighed approximately 17,000 lb. and would have required a 7,000 lb. thrust engine, Gush said.

T-38 Dimensions

T-38 measures 42 ft. 8 in. long, has 23 ft. 3 in. span, is 15 ft. 11 in. high and has gross wing area of 170 sq. ft. Basic design is a low wing of medium sweep with adjustable horizontal tail under the wing chord plane to provide desired stability and control characteristics.

The two General Electric J65 or F404 (J65 has p. 67) lightweight turbojet, fitted with afterburner, are in the aft fuselage.

All fuel is carried in the fuselage, can be refueled from the cockpit. There are two independent fuel systems, one for each engine. Fuel for the right engine is carried in the forward tank, fuel for the left engine is supplied by the center and aft tanks. Fuel pressure to the engines is provided by unpowered checked pumps without requirement for pilot attention or automatic sequencing.

Fuel can be run from fuel in case of engine or other malfunctions. Fuel tankage is placed so that there is enough hydraulic head to provide fuel for an afterburner takeoff should the boost pumps go out. Gush noted.

Electrical power is supplied by two 5 kw variable frequency alternators, one operated by each engine. The two engines functioning independently and under normal conditions each carries approximately half the load. Automatic voltage is provided in event of failure of a unit.

T-38 design threatens use of a sta-

tion turbine for emergency hydraulic and electric power. Instead, there are two independent hydraulic and electrical systems, each governed by one of the two engines.

For ease of maintenance an overhauled tank and ducts, at no cost, engine bay. Engine-driven accessories are mounted on the airframe and are driven by a jack shaft from the engine gear box, that arrangement designed to permit engine removal with minimum number of disassembly.

Engines are started using a carburetor venturi on the left engine; right engine is started using left engine compressor air bleed.

To provide ample working space in the engine bay, the fuselage aftershock can be removed by unbolting four bolts. Centric to normal position, the aftershock is a rigid that the vertical tail remains in place on the fuselage, when the after section is displaced. Northrop estimates that this feature provided a weight saving of 100 lb. over more conventional method and is additional safety feature of the fuselage splitter in high winds.

Winged Windshield

Accessibility to the instrument panel is provided by hinging the windshield at the forward edge allowing forward of canopy to be pivoted.

Wing based tests indicate that the T-38 has excellent lift characteristics with lift coefficient increasing with angle of attack well beyond the stall. Gush claimed. Adequate elevator control is maintained at angles up to 18 deg. permitting use of elevator for spin recovery.

Ground tests show that longitudinal stability, increases as the stall is approached and then favorable considerably beyond the stall. The airplane can be landed with one engine inoperative, according to Gush.



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FLYING ARROWS loop over ML 6 Blenker Hawks. At last Farnborough show, team beat 37 aircraft of nearby field to get now in air

RAF Team Maintains Operational Status



FIFTH aircraft with difficulty, some one pilot went down in place other than leader

Nasty. World, England—British's Royal Air Force Flying Arrows, best of the world's military aerobics team in its five aircraft in full formation sequence, and only perform at Farnborough in display but simultaneously perform an operational role in British air force.

At last September's Farnborough air show (AW Sept. 5, p. 26), the RAF team exposed open its five-annual test in rolling and looping over ML 6 Blenker Hawks in a crowd-placing low-altitude demonstration.

Squadron No. 111 has no more pilots or aircraft than any other RAF fighter squadrons and team members are picked from among the pilots serving as operational tour with the unit.

Not Privileged

Only major reason that the squadron makes its aerobics equipment is that its 16 ML 6 Blenker Hawk jets are painted black, rather than the usual RAF blue and green.

Squadron Leader Roger Topp, commanding officer and team leader, admits that the squadron members

"are operational efficiency even during the summer months when the team performing at maximum are shown. It is not uncommon for a team member to fly an operational mission on his third flight of the day after two previous sessions of aerial stunts."

Continued. Fighter. Command posts the limit of passing the RAF aerobics team to a different squadron each year. But in 1938, for the first time, No. 111 squadron will supply the team for the aerial tour ending.

Royal Air Force believes the fact that the Flying Arrows are part of an operational unit and emphasizes more than anything else, that precision flying of very high quality is the expected standard for Royal Air Force pilots.

An Marshal Sir Thomas G. Pile, Air Officer Commanding-in-Chief, Fighter Command, says of Royal Air Force training on the team's role this way:

"From front to back, various squadrons are selected to represent Fighter Command in display at home and abroad, so that the public may see for themselves the standard and ability of the fighters they have bought for their defense. This year No. 111 squadron has been selected for this duty, and although their show is spectacular, this high standard has not been achieved at the expense of normal training. There are no lighter pilots—not more per formers."

No Official Name

Actually, the Royal Air Force team has no official name. It's also been tagged the "Black Hawks" and the "Tie-Breaker" unit, a designation Squadron Leader Topp says is such as their headquarters should go to the whole squadron. But the Flying Arrows, which passed on to the French at the Paris air show last month to visit, modified.

"The present team is not the first RAF team to use five aircraft. The Vampire team of No. 41 squadron appeared with five at the 1938 Farnborough display. But the Flying Arrows are the first to introduce the idea as a permanent, international team with high speed sweep wing jet aircraft."

Reason behind the use of five is usually a competitive one. "The European form of current international air show and there has been no one in the same air show is unofficial but quite serious competition (AW June 17, p. 16).

"No one has any difficulty expressing a mood if you are the only team there." Topp points out. But the urge in the competitive European situation is to provide something just a little better than the other fellow.

"Usually, all six teams run as in loop and visit," the RAF leader notes. "And from that, you make your aircraft around the leader to make other shapes. With five, you can make



TAKESOFF is a modified Vee formation with No. 2 and 3 deep set wide and behind leader. Leader holds himself open to 7,000, compared to 5,000 top of Hunter's Arm



ARROW formation (above) is made with No. 3 and 5 to left, No. 2 and 4 to right. Chief four formation (below) resembles the five of clubs. Team never currently consists of 10 pilots.



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sharp angles can make with them."

The British performance is built around the philosophy and is designed to show the team as gladiators in the quartet, in possible. For the same reason it is a performance plotted to keep them close to the crowd at all times.

When the pilots of No. 111 roll out for their home display, they have ahead of them a 10-man show which includes nine Americans. It is not extreme for the Flying Aces to fly three shows a day, from morning until dusk, because they find it less tiring. Team leader Topp also finds a G has an advantage for another reason. Experience with it enables him to do some sort of the push, being instead of working constantly in the G seat.

Maximum pulled during the team's performance is 12-14Gs, reached during the banked turn. To avoid building up formation, the Aces seldom pull less than 1G in order to maintain lock, pressure on the stick. Top speed is 450 kt and maximum speed, 150 kt.

The Avon RA.28s are used at 10,000 ft. height. Setting during maneuvers after takeoff is about 7,000 ft. up, varying slightly depending on temperature and altitude, and occasionally is eased back during rolls.

Talbot is in a modified tail formation with No. 2 and 3 ships set wide and slightly behind the leader. Numbers 4 and 5 are behind them, wide of the leader but on the inside of No. 2 and 3. Topp holds talbot up, at the lead aircraft is 7,500, compared to the 8,100 top for the Hunter Avon.

"Yes, go," Topp calls as soon as wheels are up. All of the unit's radio commands identify the type of formation coming up with "go" as the operative word. The diamond line is the basic unit of the five ship team.

In this, the No. 2 and No. 3 wingmen are two feet below the leader with one-half their wings wing enveloped in his wings. The crest man, No. 4, flies 10 ft. below the leader with his nose just overlapping No. 2's jet pipe. No. 5 is 45 ft. below the crest aircraft with its nose overlapping the tailpipe of the aircraft above him.

In the formation, the Flying Aces sweep back across the field, banking to present as much of a plain view as possible, and shifting at an altitude of 100 ft. to a half-moon with No. 2 and 3 dropping back to fly wing on No. 4, who together with No. 5 holds his position. The team then loops to that formation, coming across the corner, at as close to a right angle as possible without going over the crowd.

Commencing another loop the unit drifts to a cross as its nose comes up 45 deg above the horizon. In the formation, the wingmen are line abreast with the crest aircraft. Going over the top of the loop at about 6,000 ft.,



ROLLING in basic line formation, the Flying Aces prepare to shift to...



HALF SWAN, with No. 2 and 3 dropping back to fly wing on No. 4, who holds on No. 5.

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the team returns to base, directed by and guided down the runway to front of the crowd after a 500-ft. pull out.

Topp then pulls a wide arc to bring the team to toward the other edge of the crowd, shifting at the end of the arc into a W for its study loop. This is a somewhat similar shape to the modified fork used on takeoff but special wider for the visual effect even which goes it is labeled.

Coming down the far side the team shifts back to the directed line and does a straight roll on front of the spectators. Going up on the next loop, the team moves into fork formation. In this No. 2 and 3 wings hold their position on Topp with No. 4 and 5 sliding in to trail behind them. From the fork, the team goes to its arrow formation on the far side of the loop. In this, as in the fork, odd numbered wings are to the left and even to the right.

Fork Simplifies Turn

After crossing in front of the crowd, the team slips back to a fork to simplify turning and then executes the air rolling as it once more passes the crowd.

Shifting from arrow to fork to bow, the team slips back to a fork to simplify turning and then executes the air rolling as it once more passes the crowd.

The five-armed symmetrical, star producing a single stroke as this maneuver a roll to left in front of the crowd, shifting from the end formation to bow while shifting.

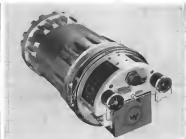
Topp pulls up in a steep loop with his wings spreading to a final broad arc as they go.

Then comes the launch burst. As the



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LEOP loops in two banks in broad arrow formation at beginning and end. Its bank turn is from top out of loop, lead ship leads straight down. No. 4 and 5 arrive through 180 deg. turn, then back off 30 deg. No. 3 and 1 turn through 90 deg. and back off 10 deg.

From top out of the loop, the lead ship leads straight down. Numbers 4 and 5 arrive through 180 deg. turn, and then back off 10 deg. Numbers 3 and 1 turn through 90 deg. and back off 10 deg.

Everyone dives to a 500-ft. pullout and, using banking angle, rolls onto in a series of maneuvers. Reformation, the team comes back in echelon to port of the leading.

There is no bad weather sequence as such for the Flying Aces. If outages on live air takeoff, as they often are in Europe, Topp will improvise as he goes along. "We'll push a hole for a loop if we can," he says. "People like to see a loop when everyone else is just doing rolls." When held by a rainstorm, he'll slide the extra flexibility of the five-ship formation into the Aces as putting on a more varied show than possible with a four-ship team. If there's any fog at all, we can usually do something," Topp says.

Weather Flexibility

He believes death in keeping the team's bad weather approach as flexible as possible. Then a check flight a few minutes before the performance has gone smooth, as rapidly during weather. The team leader points out.

The last that there is no preset low altitude there can be an advantage in it seen in Norway last summer. When the team took off for its performance at Oslo on August, the day was pouring rain out of low clouds. Working slowly the Flying Aces found their way had a 4,000-ft. cloud base in places. They were able to run through their complete show by taking advantage of this although it had appeared at times that even a roll might be difficult.

The Flying Aces have found that the worst complication, arising from the addition of a fifth aircraft to the formation is that one pilot always is leaving to someone other than the leader, assigning time logs and making precision maneuvers more difficult.



Wing over a performed with team in both banks at the last work. In addition, the more than most maneuver team are available for an increase the complexity of the performance.

"If you've got five aircraft, you should see them to produce shapes that are effective even though they can be complicated to fly," Topp said.

Miss-Skip History

The nine-ship formation which appeared at Farnborough was reintroduced for the second time in a British show. The Flying Aces wanted to do something with an extra touch of the spectacular they also wanted to bring more of the squadron into the act to emphasize that they were an open team unit, not just a team.

The pattern was forced with the original team in its broad arrow formation and a second flight of four in a diamond has moved close behind, with the leader of that flight forming an Topp's aircraft. The nine black Hawks did a straightforward loop and then a roll before the formation split up for the regular five-ship performance.

This new five-ship formation also appeared at a few more British shows in 1974 but again. Topp doesn't plan to take it to one of the international flying displays. For one thing, he considers it would be an imposition on the hosts who already get a lot of exposure. For another, it almost certainly would be necessary to remove the squadron from operational duty if it was expected to put nine ships into the air for each show. To provide five aircraft at a longer show, Topp takes seven. At Farnborough it was necessary to keep 12 aircraft at the nearby Odiham base to put most in the air each day.

At British shows within reach of the squadron's home base at North Weald the team leader is facing with the idea of a performance which would start with a rough aircraft, adding one at a time until in total 12 would be performing formation aerobically. But that

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Pioneers in developing aircraft vibration-control devices

in which a Yopp will sit about 1970 place.

This advance points up the competitive spirit which has developed between the European teams, particularly in the last year. Most teams worry whether their design is sound during the season but the end of the season has had them working new ideas into their next year's program. Since the number of things that can be done is limited, it's not easy to be different.

At the 1957 Milan show for example, five of the six teams appearing were using a basic four-shape formation and of these five four were flying the same aircraft, the F-50 Sabre. Thus, the team with the "Spanish" in this case, the Flying Armor with five men, had a real edge.

Yopp expects at least one more team from the Italians, to adopt the five-shape formation next year. In fact, it is likely someone will pick up the Italian formation leading which proved such a crowd buster at the Paris show.

Show Planning

Careful advance planning goes into the 10-man appearance of the Flying Armor at an international air show, some 10 days before the show, Sigla Ltd. Yopp, accompanied by a marine radio officer, flies the squadron's utility Meteor jet to the site. He makes a thorough check of runway approach and ground position, normal traffic at various radio frequencies and any other factor that may have an effect on planing the performance. Particular attention is paid to landmarks in the area and to any unusual obstructions. At one location, for instance, Yopp found that a slight hill would block part of the team's usual demonstration from the crowd. So a change was made in the team's normal flying pattern.

Yopp also is concerned in learning what other teams will appear, since the quality of the competition can determine a high point to bring with him. Moreover, the maintenance effort, checks on availability of local supplies and determine what the team will need.

After Yopp returns to the team's base at North Field, practice sessions are laid out in the light of what he has learned. He has checked for instance, on where the run will be at the time of day this are scheduled to appear. Practice sessions are then set up with the use in that position. The team makes at least two practice flights a day in the week, preceding the display.

Two days before the show, the team flies to the site, making a few severe altitude and points. If adverse conditions can drastically from them in which the Flying Armor have been practicing, Yopp may call for a full

practise session at the field the day before the show. "But usually we don't like to go on doing away," he says. The team likes to fly the day before the show if possible, doing over the local area and perhaps running through a few formation patterns at some distance from the field. This helps bring it back up to time after the previous day's very tight, often made with dry feet.

On the morning of the show, Yopp keeps the team relaxed and away from the exhibition. "We take it easy and perhaps have a Coke." The armor stands in the area from the field until just before showtime. After the per-

formance the team stays overnight, in having to base the next day. The group then a chance to compare notes with the other teams in the show. It's a sport of changing, in the RAF leader calls it is still an opportunity to enjoy none of the local hospital.

Regular squadron maintenance personnel from the ground crew of the Flying Armor. For an estimate performance, the team takes 75 or 76 men in its ground crew, with RAF Transport Command providing the aircraft to fly them. For a performance in the United States, a team of ground crewmen are considered minimal.

A commentator, who usually is not

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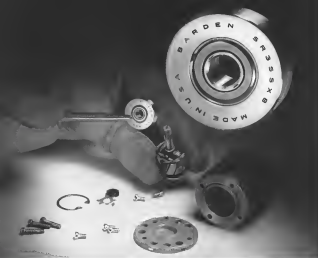
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a flying machine, of the Arrow exists but a person chosen for his "extraordinary" ability is taken to it. English speaking there.

Team members are pulled from among the pilots serving a normal 24 or more of duty with the squadron. "Now pilots are watched for formation splits and now, get a chance to try out for the Flying Arrow, within six or seven months after joining the squadron. But there's more to it than that."

Most of the squadron use 8 1/2 bar carbon steel tubes. "Topp says, but not all of them have the personality, he continues, though. It takes a man with a certain personality to go to a big air show, engage in conversation with other teams and stand up under the stress and strain he says.

"The team leader calls it the 'big match' personality.

Like an actor on the stage or a combat pilot with bullets whizzing at him—experience helps," he says.

After a month of living with the team the new man may get his chance to fly at one of the major air shows at Ft. Belvoir. That is where Topp can tell whether he is team material. If so, he goes on the roster of the Flying Arrow's ten pilots as far as the roster.

In 1972, there was one reserve team leader, an F105, there will be two. Team members shift around quite a bit in the various slots and reach a standard where Topp says it is difficult to tell who is flying what position.

There's nothing supernatural about it, says the squadron commander. "We feel we will be more successful if we trust it is an advanced form of squadron training."

Although the team participates in some outside public relations activities, there's none of the publicity, silver star accompaniment, the appearance of an American team partly because its dual role is part of an operational and doesn't have much time for it and partly because the RAF believes the team's role will sell to people of British sites. Looking over the hectic schedule of public appearances is an operation with a record 30 years or more of the U.S. Navy's Blue Angels (AV, Nov. 15 p. 77). Says Lt. Topp, "I don't see how they live through it."

During the past season, the Flying Arrow took part in more than 50 air shows, four of them in foreign countries. This number is expected to increase in 1976. Like the other teams, the RAF unit is using, all of us, to work up its next year's show. The Sept. 15 Battle of Britain anniversary—during which the team flew four shows at different sites in one day—in addition to making one from highlights the last formal appearance of the Flying Arrow, until about April.

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Fairchild Builds Facility for Small Jet

Dear Park, N. Y.—Fairchild Engine & Airplane Corp. Engine Division contract to fabricate all small gas turbines of less than 5,000 lb thrust was endorsed in its completion of a \$21 million small turbine development facility here.

Fairchild is certain that a need for lightweight small turbines exists and will grow. The division points out that not only is there the looming commercial field with executive transports such as Lockheed's Jetstar (AW Sept. 15, p. 29), but that in an international satellite market cold war—with its one constant "small war" or subsequent nuclear fallout—there would be tactical and logistic need for small jet vehicles.

Savings with high thrust-to-weight ratio small jets would begin with development, continue through production and become even more pronounced in operation and maintenance, according to Louis W. Dixon, assistant to the vice president in charge of Fairchild's Engine Division.

More Than ICBMs

In general Fairchild seems to agree with other segments of industry that current pressure must not be allowed to cause the United States to end up with a stockpile of ICBMs and nothing else.

Actually many turbojet experts contacted recently by AVIATION WEEK in government, universities and industry agree the country has a long way to go before exhausting the possibilities of air-breathing engines.

But here, Fairchild's 2,800 lb thrust J63 will fare against the competition offered by General Electric's J65 of similar size and power in a matter of several important to Fairchild. Obsolescence in the field do not appear to believe it is likely that both engines will be put into production. The engine which wins the last military applications—such as the Northrop T-38 supersonic trainer—will then continue to lead the field, according to these observers (see p. 10).

J63 Glowup

Change of J63 made Fairchild's attitude chamber indicates that it is roughly a 15 ft diameter small flow turbine. Tom remarks which have been made by Fairchild engineers it can be assumed that it is a single speed engine, with roughly a half dozen compressor stages, no variable geometry intakes and possibly not even variable inlet guide vanes or stator vanes. Performance will be thrust toward high speed Mach 2.5 flight where static fuel consumption (and to be 58.99) will be offset



FAIRCHILD Engine Division's 480,000 sq. ft. of shop space can be expanded 10 times on the 100-acre site. Main offices are at the end of the drive, manufacturing behind.



WATER COOLED composite combustion burner runs 1,200° combustibles in hot mixture up to Mach 2.25 before burning. The J63 is test unit; it is not fully (left) and finished unit (right) in the right. A 40 ft. duct house will be installed alongside.



TWO CLARK industrial type compressors in production supply air for the engine development facilities.



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Is it possible to build a **MAN?**

Theoretically, yes," said the scientist. "Or a reasonably remarkable imitation—a kind of mechanical analogue. Call it a *Mani* machine, a mechanism operating according to the laws of the conditioned reflex."

Has man that you could actually build a mechanical mind? One that would exhibit emotions—such as love, fear, anger, loyalty?

"We're doing something like that now in advanced missile development," the scientist replied. "In a limited, highly specialized way, of course."

Take the "pic" that is being developed for the big long-range missile. He has a wonderful memory, and can solve many complex navigational problems in a flash. He loves perfection, and actually becomes highly excited when he gets off course. He's a tough-sledded character, impervious to the cold at several hundred miles altitude and the incredible heat at re-entry. And his loyalty is heroic. His life is a single mission, the mission his whole life...and maybe ours, too. He's a pretty important fellow.

What about the complete man-made Man? What would that entail?

"A mechanism the size of the capitol in Washington, and the best scientific resources in the world. But it could be done. You see, it's only a question of how physical matter is organized. As a great biophysicist explained, if material is organized in a certain way, it will walk like a man. If it is organized in another way, it will fly like a missile."

Still, wouldn't there be something missing in the complete man-made Man—something very intangible?

"Yes," said the scientist. "A soul."

MARTIN
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its other factors and it ought to weight into less as 8.1 dr. There's no weight into. Fairchild Engine Division has been able to use normal expansion of its J55 program as it now had development to about 10,000 which has the design 55 inches in J73 engine casing and turbine subassembly. As of the end of 1977, the division's backlog was \$20 million, of which \$5.5 million was for J44 production and the rest mostly for continued development of the J55, and Corp. Chrysler, division general manager. As of Dec. 31, the backlog jumped to more than double \$20 million because of the unusual volume of defense spending, Chrysler and

Hiring Interest

Fairchild was showing continued interest in hiring engineers during the last years following the contract's loss, a possible indication of the strength of its small engine program.

For the time, Fairchild has underwritten a considerable program of research, as there is no doubt to be found in a large amount.

The division's new laboratory, headed by Dr. Robert Goos, formerly with Harvard University, is equipped with a 1,000-hp Mach 14 supersonic combustion tunnel and to be the first of its kind in existence.

Combustion Study

Recent research on high speed combustion in the tunnel under period support from the USAF's Office of Scientific Research could lead to such propulsion development as the standing detonation wave "scudjet" which has been studied by the University of Michigan.

A 40 ft. shock tunnel is to be installed shortly in the laboratory.

Fairchild's brand new small engine development facilities are especially noteworthy when considered in the division's 1,200 employees, with more than \$100-million annual volume now booked to run towards the end (probably less than 5,000 ft. thrust) turbojet and — perhaps — turboprop which Fairchild hopes to concentrate on, the facilities are compact and orderly.

Air Compressors

As at the facility is supplied by two Clark industrial compressors driven by a 12,000 hp synchronous electric motor. The advantages of concentrating on small engines are evident. Fairchild has been able to use increasingly available used blast furnace blowers rather than having to order specially specially designed equipment. Also, Fairchild's electrical power loads are so low that they can operate full power day and night.

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being up to 110 psi, connected in series as follows up to 150 lb./sq. in., mounted in parallel. Connected push-pull they can supply air at 50 psi and simultaneously exhaust at a 15 psi pressure while. Roughly speaking, it would seem that the supply is adequate for developing engines of up to 5,000 lb. thrust which could perform at Mach 5 and 70,000-100,000 ft. altitude.

The air supply is piped from the power house to the turbopump development building and to the basic research building.

In the turbopump laboratory the air can be taken out of the main header and vented into an altitude chamber. Two compressor test stands, a combustion chamber facility, and a turbine test rig, are also in the test facility. It was, in order constructed, but a Lockheed spokesman said that it is unlikely that any secret facilities will be added.

Altitude Chamber

The altitude chamber for complete engine testing is approximately 1 ft. in diameter, 70 ft. long, and is designed to contain internal pressures up to 50 psi. It consists of 75,000 ft. of air, is vented or with closed bottom, the internal engine performance can be held and up to 100,000 ft. During altitude runs, Franchard has water from wells on the 150-acre site to cool the engine as, least before it enters the exhaust compressor.

Of the two compressor test facilities, one is used for single- or two-stage compressor calibration. The installation can supply up to 1,500 hp at 33,000 rpm, and discharge pressures down to 5 in. vacuum. The other compressor facility can supply up to 9,000 hp at 15,000 rpm, and against flow limits, pressure of discharge up to 100 psi. At Mach 2.5, full supersonic inlet or inlet stage operation, the static air is supplied with air at 150 psi. The static air, reflected by the jet, is compressed at Mach 2.5 and at altitudes in excess of 70,000 ft., Lockheed said.

Pressure Levels

The combustion chamber test is sufficient to operate at pressures levels of 5 in. vacuum absolute to 150 psi, which characterizes the wide operating ranges expected of high performance engines. It is equipped with a preheator to simulate compressor temperature rise, and a fuel cooling system for cold start-up tests.

The turbine test stand can develop 5,000 hp at speeds up to 30,000 rpm, while actually burning fuel at typical inlet conditions up to approximately 1,700°F. Turbine performance levels match those of the compressor stand, Franchard said.

Data storage, according to company

representatives, is to follow modern state-of-the-art procedures. Procedures for, for example, are recorded on tape or punched cards for reference on IBM 490 computers. Franchard has developed an automatic probe system and time-recording system. Hot wire anemometers and orifices are also mentioned.

Franchard Chief Engineer S. V. Gough said American Vista has the company works in some detail, step-by-step through compressor testing, no step, however, in operation and then, testing the next step by simulating the conditions which come from the first steps. In this way engineers make sure that each step is doing its full share of the work, and the whole system between the steps.

To prepare its facility, Franchard expects to be following a policy of offering young engineers' internships with graduate-level flight control or turbochargers. For example, one engineer has prepared coefficient tables and teaching design of compressors. Another engineer is doing a master's job on the heat. These men are held during their working hours, Franchard also shares in cooperative engineering programs where potential engineers who otherwise might not be able to attend college can take a degree in two years by alternating between some college in the plant at University of Denver.

Japanese May Build 42 P2V Neptunes

Tokyo—United States Navy and Japanese defense officials have reached a basic agreement on the production of 42 P2V Neptune. A second agreement it is hoped, will be signed by the end of March.

Under the tentative plan, Kawasaki Aircraft would turn out the planes at the rate of one per month from October 1958, to March, 1961. Cost is roughly estimated at \$75 a million, to be split by Japan and the U.S.

The Japanese hope to start preparing for production later April, if a final agreement can be reached by then.

Japan Using Missiles To Gather Jet Data

Tokyo—Kawasaki Aircraft has recently built seven missile ramjet engines on a trial basis at the company's Gifu plant to obtain data for the design of supersonic jet planes.

In a series of experiments at the foot of Mount Fuji, the test missiles were shot to an altitude of 10,000 ft. at a maximum speed of Mach 1. Missiles are eight feet in length, six inches in diameter, have a nose wing, four tail fins eight 19 in. and one wheel fairing.



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aircraft industry fastenings in addition, they are supplied in the volume needed to keep production lines moving on schedule. The Santa Ana plant has the highest rivet capacity in the world.

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COCKPIT display is VTOL, window being developed by Ryan Aeronautical Co. enables operators to visualize transition from horizontal to vertical flight. Computers were simulator

Ryan Develops Jet VTOL Display

See **Diags**—Development of an all-weather cockpit display that gives jet VTOL pilots information for transition from horizontal to vertical flight is under way at Ryan Aeronautical Co. under USAF contract.

Display, which provides the required information at the ideal level of 400 ft above ground, also meets certain tactical aircraft display requirements.

For accomplish developmental work, Ryan constructed a simulator attached to two General Electric Differential Analyzer (GEDA) and two Pico-Processing Computer Electronic (PAC) computers, with resolution movements controlled by computers to duplicate aircraft movements and responses.

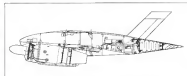
Ryan philosophy calls for presentation of "what is happening" and "what should be happening" information to the pilot in form which requires no in-

terpretation, is in terms of cue or control action the pilot must take.

After eight months of preparation work, including simulator construction and checkout, 25 volunteers who were former soldiers, pilots were selected and divided into three teams of six, with five as alternates. Each of the teams trained with a different display in the workshop.

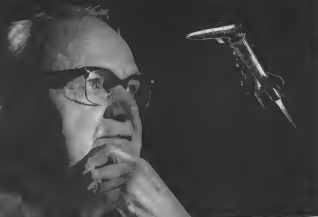
Each of the six operators spent a full day on the simulator, none of two full hours of familiarization "hang" and practical simulations and takeoffs. Following routine tests, each subject attempted 11 actual transitions and landings within a 50-ft circle "under the hood."

Results of tests were determined and overreaction generally is under way in a cockpit display embodying test results, which will be shown to Wright Air Development Center officials.



How Firebee Is Arranged Internally

Cutaway drawing of the Ryan Firebee target drone shows pressurized heated fuel tank, wing, exhaust duct, the fuselage. Fuel tanks are above and behind flight deck of the engine. Exhaust duct is behind the fuel tanks and the recovery parachute is located in the tail cone.



ANTI-MISSILE SYSTEMS

A Research Project of Dr. Henry Nyquist, Senior Scientist, Stavid Engineering, Inc.

Dr. Nyquist is a pioneer in advanced areas of electronics such as Information Theory and Control Theory, and is credited with nearly 150 patents in the field of command systems. He is now contributing his exceptional scientific ability to Stavid's work on a far reaching anti-missile system. Also like Dr. Nyquist are typical of Stavid's outstanding scientists and engineers who are working on advanced concepts . . . years ahead of actual systems development.

In Stavid's adaptive engineering atmosphere, scientific development and engineering focus are producing a wide range of electronic systems for all branches of the military. Typical of such projects is the 9000 UH1M missile command guidance system, designed, built and operational in operational status by Stavid.

STAVID Engineering, Inc. Patfield, New Jersey

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CURRENT STAVID PROJECTS INCLUDE:

- Advanced Search Radar and Search Electronics Filter
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- Missile Guidance Systems
- Anti Aircraft Submunition Fire Control System
- High Power Air Search Radar

AVIONICS



FRENCH-DEVELOPED diversity radar requires three transmitters, each operating at a slightly different frequency, to provide greater effective range and reduce susceptibility to enemy jamming. New radar will be evaluated soon by the First Cambridge Research Center.

Three-Frequency Radar Has More Range

By Philip J. Klaus

Breford, Mass.—French radar which employs new technique that repeatedly switches effective range by up to 15% makes the radar too vulnerable to enemy jamming and gives greater operational reliability will be evaluated shortly by Air Force Cambridge Research Center.

New radar technique, called "diversity radar," employs two, three or more radar transmitters and receivers, each operating at a slightly different frequency, but sharing a common antenna and video display. Jamming diversity techniques have long

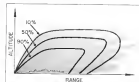
been employed in radio communications and currently are being applied in U. S. radar developments.

French radar was developed, and built by Compagnie Generale de Telegraphie sans Fil better known as CGS. Equipment was purchased through its transatlantic Electronics Corp., called Inter for short. The latter is partly owned by Aerospace Instruments Lab, outposts of Minsatco, N. Y., Compagnie Generale de Telegraphie sans Fil and three U. S. and French investment firms.

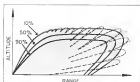
The production model diversity radar that Cambridge Research Center purchased consists of three identical

radar transmitter-receivers ("A," "B," "C") of conventional design. Transmitters operate in S-band, each at a slightly different frequency roughly 10 mc removed from the other two. All three transmitters and receivers are connected to a common waveguide and antenna through a mixer which permits each to be connected to the antenna as required.

Normal cycle might consist of a two waveguide pulse transmission from "A" a one waveguide interval followed by a two waveguide pulse from "B" followed by another one waveguide interval and then a two waveguide pulse from "C." The cycle



CONVENTIONAL single-frequency radar coverage is not solid but consists of alternate empty holes and voids produced by ground reflections. Typical 10%, 50% and 90% detection pulses shown.



DIVERSITY radar transmission on a second frequency produces shift in detection portion of holes (dotted) which partially fills in the voids in coverage of a conventional radar.

**CENTURY MODEL 409D
RECORDING OSCILLOGRAPH**

Numerous agencies engaged in the manufacture and evaluation of missiles have turned to the Century Model 4090 Recording Oscillograph as a reliable means of collecting missile performance and control data.

On-board mounting eliminates the necessity for the costly and often not reliable RF link.

The ruggedness and reliability of this 12-channel oscillograph have been demonstrated many times. One agency reports having recovered 42 satisfactory record rolls out of 43 firings. Another, using special mounting configuration, reports recording at 60 G's without damage.

This 13 lb instrument is compact enough to be installed in most missiles and all electrical connections including remote control are accomplished through a single multiple AN connector.

CENTURY ELECTRONICS & INSTRUMENTS, INC.
1888 North 44th, Tulsa, Oklahoma

Target values received on each of the three frequencies are displayed in appropriate manner associated to video signals and suitably combined and transmitted to domestic base data by means of an original transmission device. Combined video signal is then displayed on a single video scope. The operator is assured that he is viewing the combined effects of three separate radars—except for the improved performance.

Coverage of a satellite-based network under frequency is shown as a solid volume, but in reality it consists of a cluster of narrow beams called "lobes." Near the antenna these lobes overlap to provide total coverage, but farther out they do not overlap, leaving voids in the coverage.

These lobes and voids result from radar energy which is reflected from the ground into the air where it combines with radar energy arriving by direct path. When the two signals are in phase they reinforce each other. When the two signals are out of phase, they cancel leaving constructive voids.

If the position of the target coincides with one of these loads it occupies order advantage until target altitude or position changes so that it is no longer within a valid or valid on-range.

The position and extent of each wedge in radar coverage depend, for example, on radar frequency, the height

of the stream above ground and the extent of the surrounding terrain. No-radar satellite coverage patterns are useful in establishing a living network of known attitudes and bearings to determine at what range they are first received by the receiver.

puted in the radar. From each data it is possible to plot possible detection profiles which show for a target at what distance and altitude a target will be detected 90% of the time, (these distances for every 10 m altitudes of the antenna). Sample profiles are plotted for 10 and 100% of the time detection. The 100% profile, naturally, is considered the predicted operational range of the radar, CSI operational use.

Position of the filter and coils for an given order installation can be shifted by changing its operating frequency. For example if frequency is increased, the position of the filter will move slightly in elevation. If frequency is decreased, the shift is reversed.

Thus a diatomic molecule absorbing a sequence of three pulses each at different frequency, produces three clusters of lobes each of which is shifted slightly from the other in direction.



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This partially fills the void in order to merge fuel costs in a concentrated order.

Deconvolution also provides improved performance for still another system. The effective radar cross section of a target which decreases strength of its signal returns, to the constructive of one, particularly at aspect angle (viewing angle). Thus at one aspect angle and at one radar frequency a target may return a weak signal whereas, a slightly different frequency produces a much stronger signal for the same target aspect angle.

French Air Force tests on a three-fingered, discrete tube, according to tests revealed the following gains over a distance of a conventional tube of the same peak power:

- 10.11% increase in the coverage of 10% detection profile
- 20.25% increase in coverage of 50% detection profile
- 30.55% increase in coverage of 90% detection profile

One of the simplest and most ef-

One of the simplest ways to add more users was to combine the video signals from the three different solar receivers to add them directly. The signals would add linearly, whereas the noise in each channel does not thereby, causing signal-to-noise ratios. The reason that noise does not add linearly is that it varies randomly and independently in each channel, providing there is adequate frequency separation between the channels' transmissions.

Both theory and experience indicate that the simple addition of video signals provides optimum video range. CSF and Howell find technique is valuable to users, computer-aided or unaided, over other means, as this, because it is only necessary to present the three frequencies in order to have the perceiving signal appear on the video receptor's scope.

I must have devised other approaches

is a signal combination which make the value considerably less vulnerable to constraints on a threat scenario, compensating the gain of demands. One isochronic involves the addition of video signals from receivers "A" and "B" from "B" and "C" and from "C" and "A". These three partial sums are then combined together: $(A + B) + (B + C) + (C + A)$. If one of the three frequencies is being jammed, for example "A", there will be "noise" in the first and third terms of the frequency expression, but none in the middle term.

Since the product of three terms is

to if any, one of them is a two fold amplification efficiency, versus the growing signal from the combined

Another technique for joint network signal combination takes the form of $(AB + BC + CA)$ with the primary signal measured for the same reason as above.

If the system should employ single feed frequency, jammer the additional combination technique of signal combination "pseudo randomization" protection against "jamming" CSI system.

If the system employs two jammer each operating against a different one of the diversity radio channels the signal combination technique is not effective. However, it is possible to quickly "dislocate" signals from the two channels being jammed and operate on the third frequency as a diversity based radio.

Should the same model be

Since the laser emission mechanism transitions against all three of the growth rates's frequency, the radar operators must resort to other relevant techniques employed in conventional radar.

It is conceivable that a discrete type pumpout could be designed which after skimming, the lip would

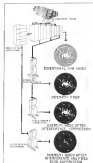
peaks, and internal duration and type than any of the derived rules could separately give the three frequencies. However, such a directly parameter model is a considerable complexity.

Another village west of Durant

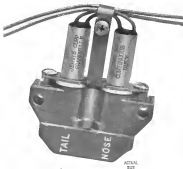
radio according to CSF, is proven to exhibit a three-frequency dynamic behavior, each of whose transmitters is rated for peak power of $1P$ has equivalent performance to a conventional radio with a single transmitter whose peak power is $3P$.² CSF may. But the dynamic radio can be operated as a conventional single frequency radio despite failure of one or even two of its transmitters, as shown.

Most existing military and industrial base dual transmitters have been modified but usually only one of them is responsive at any one time. This should be rectifiable until the operating equipment lists are shut down for maintenance. Such radio installations are particularly at risk as a two-frequency diversity system, and not too much better than a three-frequency diversity radio according to CSF. Yet this lack hampers the performance and the reliability of the diversity radio.

The three big-screen, diversity-rich videos Cambridge purchased cost about \$750,000, not including delivery. The Center plans to use its existing U.S.



COMPLETE French diversity index water includes storage-type cathode or tubes to suppress interference and level other



JERVIS

bomb arming assembly, model 51901

Guaranteed to meet MIL specifications

There's no margin for error with the Jervis Model 51901 — either in its performance or its manufacture. This lightweight, completely sealed electro-mechanical bomb arming assembly meets Military Test Specification MIL-T-7514 and the Military Standard Specification MIL-S-19193. Anticipating the need for such a device which would perform reliably under the most severe salt spray, humidity, and icing conditions, Jervis independently engineered the 51901. Each component and assembly is individually inspected for compliance with both Jervis and government quality standards. You'll find the Model 51901 already in wide use by many aircraft manufacturers.

Jervis' reputation for building better-constructed control devices dates from World War II. Currently in production are various alloy steel welded assemblies, deep die stampings, and machined parts for the leading manufacturers of helicopters, jet, jet-prop, and propeller aircraft engines. Your problems are met at Jervis by complete engineering and production facilities. Laboratory control, X-ray, dye/dye and all necessary supporting equipment are added routinely to meet existing government specifications. Welders are certified for stress, resistance, and crack welding. For precision manufacturing of close tolerance components, consult Jervis... today.

AIRPORTS DIVISION

JERVIS CORPORATION

Grandville, Michigan



antenna in the calibration tests.

The French have developed several other design innovations which are applicable both to the diversity radar and conventional types.

• **Pseudoecho suppression**, a coherent type of moving target indicator (MTI) which employs a narrow tube instead of conventional delay line to store echo signal and compare it with subsequent echo to determine which signal returns are from moving targets which have been detected. French technique has several advantages, including CSI, including simplicity of object count, improved stability, and the ability to accommodate variety of pulse repetition rates. The CSI feedback system can be used with an MTI equipped with stabilized local oscillator that can be adjusted to permit radar intermediate frequencies. The unit can be equipped in an analog stabilized in which can be provided.

• **Interference suppression**, and to "zero beat" electronic random noise peaks whenever echo signal level exceeds noise level, providing extremely high contrast display on radar scope. The CSI interference suppression employs a heterodyne type storage tube for comparison of successive video signals, passing into the scope only those echoes which are in excess of it in the same rate as the radar's pulse repetition rate.



Display Range 4,000 Mi.

Radar display with maximum range of 4,000 mi. has been developed for MIT-Lincoln Laboratory's McMillan 1801 radar display unit (AFW No. 25, p. 14) by Atlas B. Du Mont Laboratories, Inc., under an Air Force contract. Presented a conventional B scan on 16 in. cathode ray tube with 150 deg. smooth coverage, and includes variable range and automatic range expansion. Radar search area radius, height, and antenna position. Although pulse repetition frequency of the radar has not been released, no clearance for calibration shows that to obtain area range with maximum power it would be in the order of 30-35 pulses/sec.



This McMillan radome assembly was specified by both Capital Airlines and Vickers-Armstrongs!

In selecting a radome assembly for the famous "VINDUENT" both Vickers and Capital sought a manufacturer with new major qualifications—long experience in radome design, development and production, and superior electrical testing facilities, for guaranteed performance.

They both specified McMillan.

In the assembly illustrated above, McMillan supplied a complete "kit" including the radome, microwave absorber material (type "T") and backing, plus the necessary hardware to affix them. McMillan made two radome designs—Honeycomb Sandwich for X-band and Solid Laminate for C-band. The unique hinge design of the mounting hardware affords easy maintenance and repair of the radar equipment.

Naturally, manufacturer—commercial airline—private aircraft owner—each can take advantage of these "one major qualification" offered by McMillan.

For your nearest McMillan Radome Assembly "Kit" dealer, see opposite page.



McMILLAN INDUSTRIAL CORPORATION
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Moscow?



NO! MANHATTAN

The photo at the left shows how New York would look under heat detection equipment. But, if the light on the New York looks like an infrared sensor system at the moment, it is not the city lights you see, but every other sensor in the system is ready.

Anytime ANYWHERE can be seen by INFRARED—anyone looking by an electronic sensor system. But, if the infrared sensor system is not in operation, or is in operation when the infrared sensor is not in operation, the infrared sensor is not in operation. The infrared sensor is not in operation when the infrared sensor is not in operation.

The infrared sensor is not in operation when the infrared sensor is not in operation. The infrared sensor is not in operation when the infrared sensor is not in operation.

Infrared sensors only the infrared sensor is not in operation when the infrared sensor is not in operation. The infrared sensor is not in operation when the infrared sensor is not in operation.

For specific information on infrared sensor systems, contact the infrared sensor system at the infrared sensor system.



SERVO CORPORATION
OF AMERICA

1000 10th Avenue, New York, N.Y. 10018

FILTER CENTER

► Broadband Jamming Antenna—Continuous jamming antenna covering 100 bandwidth, capable of operating at high or low rates of speed and with power for burst tilting through a 60 deg angle by means of a passive reflector, has been developed by Phil and E. Wayne Neufman, Miami. The plug-in radiating elements permit wide band operation.

► Converter for 12-Volt Automob—A car antenna converter Type TMC-1 which permits use of standard 27 Mc antenna wire equipment in older aircraft with 12 V power antenna is now available from Collins Radio Co. The 7 lb device provides 10 amp continuous output, 15 amp for intermittent duty, converts approximately 9 x 12 x 14 in.

► Rugged Klaxon—Klaxon tube, which was modified in order that it was intensively ruptured during final phase of its reproduction test flight, fell 14 in into the sea and was later salvaged from ocean floor and returned.



for information, then provided to the system 0017 of its ideal operating frequency. It is called, according to Space Guidance Co. which produced the tube. Space Guidance Co. which produced the tube. Space Guidance Co. which produced the tube.

► Fiscal 1958 Science Income—Do-able electronic equipment for first quarter of 1958. The first quarter of 1958. The first quarter of 1958. The first quarter of 1958.

► New Show-Scan TV—General Electric reports development of new show-scan TV technique which permits transmission of one image every 110 sec over conventional telephone lines. Each image is stored for instant evaluation only, not for

► 71 of an Electro-Small type of the device that can "read" hand-written messages developed by Bell Telephone Laboratories, now demonstrated at the new Eastern Post-Communication Center. The experimental device is able to distinguish between different



messages by sensing heat, mass and weight of seven small radio letters are interpreted by the second system on the face plate using a small "read" which is electrically connected to the device. Machine lights up one of a series of numbers corresponding to number system to enable operator to check its operation.

► New Airborne Ultrasonic Program—Gulf Industries has set up program to incorporate ultrasonic applications in ultrasonic, including log and using expanded program of bonded to Kerosene. Gulf Industries has set up program to incorporate ultrasonic applications in ultrasonic, including log and using expanded program of bonded to Kerosene.

► Signed on Dotted Line—General Electric Light Meters, Electronic Equipment. Department reports receipt of a 95 million Air Force contract for production of MA-5 five control systems for Republic F-105. System includes radar, computing unit, four beam computer and is designed to handle all methods of attack, including guns, missiles and bombs. Ready Radio reports an order for four C-band airborne radar from



Tuning Fork Timer

Transmitter electronic frequency standard has been developed for automatic timing system by Western Works Corp. company's Instrument Division. Consistent error is said to be one second over a period of months. Frequency range of frequency is a hundred, temperature-compensated tuning fork of laminated metal steel and one line steel.

Bethel West Indian Aircraft Co. in addition to its Vietnam Vietnam, now on order. Company also reports that Swedish Navy has specified Bethel EPA-50 automatic direction finder for its initial order of four Vinted E1-44 cockpit, which will be used in anti-air warfare.

► Marine Telemetry Survey—Aircraft from Systems, Inc., Glendale, Calif., is making money of entire field of air industry under Army Signal Corps contract to provide base for transceiver standardization of telemetry, such as radar, and electronic. Survey includes such things as types of aircraft, the greater allocation types of installation, the types of equipment and transceiver units.

► USAF Control Display—Development of new philosophy and concepts for integrated cockpit displays and controls will be subject of symposium to be



Canadian Navigator

Simple auto navigator, developed by Canadian Mission Co., Montreal, is shown installed in EC-135 used by Spent Air Force. The navigator, which operates in two channels, is designed for both manual and automatic operation. The EC-135 is based on plastic injection to simplify installation for Spent evaluation in early work.

held at Fort Belvoir, Illinois, Feb. 14-15 for security and government representatives. Persons wishing to present papers, or obtain information, should write to John H. Korman, Room 942, Dayton, Ohio.

► Acceptance for F-105—North American's Automobile Division has received contract from Republic Aircraft for a unique "removable side" for installation in an advanced version of the F-105, North American reports.

► RCA Radio for Casco—End Ev, French aircraft manufacturer, has ordered 54 ANQ-18 radios from Radio Corp. of America for installation in Casco's transport aircraft being built for Air Force and SAS orders. RCA also reports that Trans-Canada Air Lines has ordered options to buy 34 ANQ-18s.

► Know-That building shown on page 111 of Dec. 16 issue with monument in the background was Clifton Process Products Company's new 33,000 sq ft, built at Colorado Springs and will be the new Western office in Los Angeles is reported. New plant will reach double Clifton's manufacturing capacity for production of avionics and other electromechanical devices for avionics applications.

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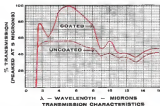
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transmission efficiency (uncoated) — Over 95% at 4 microns
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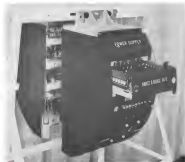
TEMPERATURE CHARACTERISTICS

transmission efficiency — uniformly unchanged from -100 to +300°C
thermal shock resistance — withstands +300 to -100°C in 1 sec.
coefficient of expansion (30°C) — 42 x 10⁻⁶ in/in/°C
conductivity (30°C) — 0.26 at 30°C/cm/°C

BASIC CHARACTERISTICS

hardness — Moh 7
density — 2.6 g/cm³
weight — only 37.7 grams/in.²
mounting points — 1472

'see' best and farthest under rugged conditions through TI grown optical **SILICON**



TUBELISS analog computer for intercept fire control system can handle many weapons



PLUG-IN submodules and plug-in circuits provide flexibility, easy maintenance

Computer Controls Weapons Firing

Bellevue—Analog type intercept fire control computers which can provide permit or hold releases electrically for guns, rockets or auto or air vehicles has been developed by Westinghouse Electric Air Arm Division.

New computer is designed to provide replacement for Westinghouse Area 50 computer now coming on line of Navy's F-4D in order to add on-line remote weapon and other new capabilities. In

order to fit the increased capability into the same size, reinforced frame, Westinghouse has substituted transistors and magnetic amplifiers completely for previous metal vacuum tubes and has constructed other major elements. Computer uses 215 silicon transistors, 226 silicon diodes and 12 magnetic amplifiers.

Plug-in hardware permit computer to be quickly changed to accom-

modate different types of weapons for numerous tactical assemblies. Majority of computing functions are performed in eight standard types of plug-in circuits.

These plug-in units and three plug-in submodules together with built-in test circuitry, are expected to simplify maintenance and trouble-shooting.

Computer is designed to operate over temperature range of -14°C to 54°C. Power consumption is only 520 w., approximately 60% less than equivalent vacuum tube models.

NEW AVIONIC PRODUCTS

Components & Devices

• **Transistor, Type 2N452**, possesses built-in (semiconductor) characteristics. Applications include complex computing circuits, bistable multivibrators, bistable multivibrators and phase detectors. Maximum collector (or emitter) voltage is 40 v., maximum emitter (or collector) current is 200 ma. Typical d.c. current amplification factor is 45, in common emitter. Alpha cutoff frequency is 6.5 mc. Manufacturer: Philips Corp., Philadelphia, Pa.

• **Magnetic shift register, Type SR-60**, are bistable and designed to operate from 0 to 60 kc. Signal to source ratio is greater than 13 to 1 with voltage drops of 0.5 v. across drive windings. Up to 30 elements can be driven with one transistor. One voltage source will supply both driver and shift register. Shift registers (2 to 16 x 8 bits) are equipped with vacuum base for tube sockets at printed circuit mounting. Other mountings are available. Export, Inc., 155 Commercial Ave., Boston, Mass.

• **Microcircuit signal generator** is frequency compensated to produce accurately 1-volt proportional to angular displacement. Used as a circular difference ball transducer with a balanced bridge, compensated to compensate for errors otherwise introduced by electrical and mechanical distortions. Units are available with 0.5% tolerance and allow



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OPTICS DIVISION
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SELECTED BY PAN AMERICAN
WORLD AIRWAYS AND OTHERS
AS BASIC LONG RANGE NAV AID



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|-------------|-------------|-------------|
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| *MIL T 4035 | *MIL T 5725 | *MIL T 5045 |

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LOS ANGELES, CALIFORNIA

able engine rotation up to a 30 deg. Stratoscopes are to 8 in./deg. with a sig. aid to more accurate better than 0.01 deg. Sec. at 14,000 ft. 8 in. in length. Lathier Manufacturing Co., 7312 Verna Ave., North Hollywood, Calif.

• **Microactuators** also, Type SC, is the set of a conventional control case. The SC is a split unit capable of revolving 3 deg. at 30 sec. or 1 deg. at 115 sec. resolve, operating on up position. 1 in. Microactuators contact pressure is 13 g., allowing a permanent



magnet to obtain operation under shocks of 100 g. and vibrations of 70 g. to 1,000 cps. adjust control operation. Unit measures about 0.50 x 0.58 x 0.58 in. and weighs 17.5 g. Batten & Brunfield, Inc., Princeton, Indiana.

• **Slide rule** developed to simplify an electronic communications system color balance solves path loss, antenna gain, link margin, distance to next radio and many other problems over the frequency range from 1,000 to 16,000 mc. It is checked on its 25 scales as Product zone distances, beam width, carrier loading and other factors relating both to TDM



and single sideband multiples radio data. Further information available from Motorola Communications and Electronics Inc., Microwave and Industrial Control Department, 1400 North Cicero Ave., Chicago 51, Ill.

• **Low voltage** capabilities, Type HT-4 features resolution resistance of 10⁴ ohms at 25C, operates without heating from -55 to 280C. Capabilities in traps are from 9.801 to 0.1 mho with voltage ratings up to 50 v. d.c. with

tolerance as low as ±15%. Balco Capten Inc., Danvers, Balco Research Laboratories, Inc., 49 Edmont Place, Newark, N. J.

• **Low noise** power diode, Type XSA 4215, improves receiver noise figures in the frequency range from 300 to 4,000 mc. According to the manufacturer, typical noise figures of 3 to 5.5 db are obtainable when used in conjunction with a 50 ohm II and I ch. noise circuit.



• **betron** Control requires no d.c. bias and offers radiation life where electron rf signal levels are limited to 150 mw or less. Typical conversion loss and noise temperature values are 4.0 db and 105. Microwave Associates, Inc., Burlington, Mass.

• **Probe**, Interference, Series 70 S429 is suitable for high current sensitive or loading local drive events in high speed digital recording applications. Transient and secondary inductance considerations are close enough to permit use as a read/write circuit. Terman



• **10:1** can be modified to match all other air current loads. Unit is rated in high temperature operation. In International Resistance Co., Computer Components Division, 401 North Broad Street, Philadelphia 5, Penn.

• **Dr. circuit** "bale" meter, Type 4101L, is designed to meet MIL R 157C and MIL R 6169C. Refers can handle the function of a "dr. circuit" rules, with those of a high current rule, these are, accuracy at low resistivity to a 30 ampere/inductive load. Unit measures 1 1/2 x 1 1/2 x 2 in. Electro-Mechanical Specification Co., Inc. 1015 North Highland Ave., Los Angeles 35, Calif.

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First published in 1964, this handbook is the most comprehensive and authoritative source of information on the properties of engineering materials. It covers the full range of materials used in engineering, from metals to polymers, and includes data on mechanical, physical, and chemical properties. The handbook is organized into sections for each material type, with detailed tables of properties and a comprehensive index.

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French Air Force Helicopter Availability in Algeria*

(The figure shows availability, bottom does not add)

| Ref | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct |
|-----------|-----|-----|-----|-----|-----|------|------|-----|------|-----|
| Ref 470-3 | 19 | 4 | 38 | 30 | 21 | 30 | 4 | 19 | 18 | 14 |
| | 37 | 35 | 34 | 34 | 29 | 34 | 24 | 33 | 30 | 19 |
| Ref 470-4 | 7 | 3 | 4 | 7 | 3 | 7 | 9 | 4 | 7 | 8 |
| | 10 | 11 | 9 | 11 | 18 | 13 | 10 | 11 | 18 | |
| Ref 470-5 | 9 | 2 | 7 | 8 | 11 | 14 | 13 | 12 | 9 | 8 |
| | 10 | 18 | 13 | 16 | 31 | 31 | 19 | 17 | 14 | 14 |
| Ref 470-6 | 12 | 9 | 7 | 11 | 12 | 12 | 14 | 14 | 14 | 12 |
| | 23 | 30 | 37 | 34 | 39 | 30 | 37 | 36 | 30 | 37 |

*Helicopters for La Seta and Beaufort at FFB Air Base in Algeria through October, 1965.

not visited the operation a year ago. Then, the base was just being built and things were rather primitive. Today, modern barracks, hangars, landing facilities and parking spaces are the rule. Commanded by Maj. René, EIC at Beaufort has 61 pilots and 300 mechanics.

There are three squadrons at Beaufort. One has 16 Alouettes, the second 10 Sikorski H19s and the third 19 H14s, although one of their recently crashed and probably is a complete loss. In addition, seven H14s have just been delivered to the Air Force in Algeria and will be assigned to Beaufort.

With La Seta's light helicopter company as well as the 1st Helicopter Squadron, Beaufort has been planning to buy Alouettes. Alouettes have been in the French Air Force since 1954, but were not used in the French Air Force until 1954. The Alouettes were used in the French Air Force until 1954, but were not used in the French Air Force until 1954.

An Air Force experience with the Alouette has been light satisfaction. René blades give some trouble at first, but now seem to be all right. The blades are not interchangeable, but will be in the near future. Turbines still are being pulled at 2,500-3,000 hr., though the French are planning to let them run for 500 hr. Air Force records show the Alouette availability, since it was operational last March has averaged 80%. The Alouette is the most available chopper in the Air Force, with 14 Alouettes are operated.

Pilot contracts in the Alouette are not much, on its maneuverability and engine speed governor with Alouette. The power limits which Alouette need to control the pitch coordination. Since French pilots log substantial time

on missions, this large saving arrangement is welcome.

Like most light helicopters the Alouette is used on a variety of missions. But two most important are evacuation of wounded and as a flying command post.

At Tunes also has developed a pick-up mission for the Alouette. An evacuation of wounded mission. When combat action is over, wounded men are taken to the hospital in the Alouette.

A North African mission takes off from Moudonville, outside Algiers and flies to the 1st Helicopter Squadron. The Alouette flies on an Alouette, as described in that when the Alouette lands at Beaufort, the Alouette is called ahead with its pilot and ground crew. The Alouette then flies the second Alouette under control. Landing at an airfield in the area where the combat took place. The Alouette with two blades mounted, but about the most, going on the wounded and bringing them back into the airfield where the Alouette, now landed with wounded, they back to the Alouette. The Alouette, its job done, then takes its own way back to Beaufort.

Before January, 1966, there were 15 Alouettes in the French Air Force in Algeria. From January, 1966 until the end of October the Air Force in Algeria published the following flight hour:

- Bell 47G-2-15, 362 hr.
- Sikorski H19-15, 174 hr.
- Sikorski H19-15, 1,915 hr. beginning in 1966
- Alouette-5, 1,192 hr. beginning March, 1966

During this period a total of 228,000 hours were transported, 6,153 wounded evacuated and 1,184 metric tons of cargo lifted.

BUSINESS FLYING



SOUTHWEST Airlines' new business aircraft terminal is at left. Two hangars at right are longer dated for April completion.

Southwest Opens Business Pilot Center

Dallas—Opening of plush new \$320,000 pilot business pilot center building first at Love Field last month heralded completion of a major phase of Southwest Airlines Co.'s \$4 million expansion program.

Terminal built for operation on a round the clock basis with flight operations facilities including direct flight to Dallas flight control center and Dallas office. Unmanned radio facilities also include conference rooms where business men can hold meetings without leaving the airport, and a restaurant.

Terminal building faces directly on runway, facing Love Field and is adjacent to four large storage and service hangars which also contain office facilities for business aircraft. Terminal is constructed on a 11-acre concrete ramp, capable of taking planes up to Boeing 707 size.

New terminal building also contains offices of Executive Vice President William Lockhart, Vice President James Lockhart, George Kelly and DeWitt of the engineering staff and Earl Webb and John Jack of operations.

Next phase of Southwest Airlines' expansion includes construction of a 100,000 sq. ft. distribution and service building behind the terminal and additional aircraft storage facilities. When these are completed Southwest will be able to handle 600 aircraft.



BUSINESS aircraft terminal's plan will be shown from outside (above) and inside (below). Terminal is part of Southwest's \$4 million expansion program.



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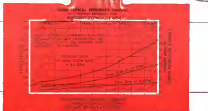
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For information on the Model AM 25-000, use the graph below, showing the reduction in particle drag and efficiency vs. concentration.

AT LEFT is a cutaway view of the Wiltrap magnetic filter element with most mechanical elements (exposed).

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Nike-ASP launched to 105 mi. altitude.

VIEW of 27 ft. rocket in ready position.



ASP, ascent stage, being fired to Nike booster.

INSTRUMENT HEAD (below) is loaded by RCV personnel.



Nike-Asp Gathers Solar Flare Data

Nike-Asp ascent rocket reached an altitude of 105 mi., believed to be a record for this type of two stage rocket rockets, during Project Sandstone, an International Geophysical Year activity devoted to studying solar radiation.

Rocket was fired by start crews on signal from nearby observation post solar flare was at blue peak. Crews had only 60 sec. remaining warning. Mount Wilson Observatory, 70 mi. distant from the San Nicolas Island launching site, tracked the rocket both visually and by radio telescopes. Measurements of X-rays during flare indicate first occurrence of low altitude produced by X-rays, cause radio blackout in the 1.33 mi. band.

Nike-Asp rocket is 27 ft. long and carries an instrument payload of 35 lb. The firing was conducted by the Cooper Development Corp., Menlo Park, Calif.





COMET loadings are rolled from fabrication shop to assembly hall, pick up assembled engine base sections and colored wing sections.

Comet 4 Rollout Expected Next Month



HAYFIELD plant (above) can hold 14 rugged aircraft. Below, sections are being assembled.



London—First of de Havilland Aircraft Co.'s Comet 4 jetliner transport series is expected to roll out next month.

De Havilland has been conducting a test program designed to assure structural integrity of the aircraft.

Program aims will culminate in the testing to destruction of a complete section under simulated flight loading which will include cyclic replication of takeoff, gust, pressurization and landing loads.

Dr. Hayfield's experience with the Comet includes:

- Some 10,000 flying hours accumulated before the crash three years ago.

- Lessons learned from the historic and costly wreckage investigations which clearly established engine down position as a new aviation hazard, and accelerated the structural threat of an old hazard—metal fatigue.

- Static and fatigue testing program on the new Comet 4 structure which is fully out precedent in accumulated history.

Long Life Predicted

Dr. Hayfield claims to have increased the overall stress levels that the fuselage in the test program should show a fatigue crack-free life of 100,000 hr—equivalent to 60 to 70 years of service or, by today's commercial life. Specimen tests already have demonstrated that even with a stress factor of five the safe fatigue life of the colon matches the design target.

The word to increase the fatigue life of the Comet has been met by:

- Increasing thickness of skin gaps

PRODUCTION

members to offset the overall stress levels.

- Avoiding sharp radii at corners to prevent local stress concentrations.

Most dramatic increases in the fatigue life of the aircraft relate to the wing where a notch was made in 245—a copper-bearing light alloy in the lower joint boxes and wing slats. Coupled with the use of multibore aluminum as a fitting agent around the joints and bolts, the fatigue life of wing joints has been increased 50 times from 100,000 gust seconds to 16 million cycles.

The new alloy, which de Havilland says has superior fatigue characteristics, imposes a slight weight penalty due to the lower strength being slightly lower than the original zinc-bearing alloy.

Low Stress Levels

Design stress levels in the 19 gpm area now used on the fuselage have been so reduced that the structure should remain entirely free from the severe noise of fatigue cracks over a period as long as commercial life. Evidence of this large safety factor means that should a crack be required by service



ROLLS-ROYCE RA 29 turbojet engine is shown above being positioned in Comet's wing nacelle.



FINISHING touches are applied to the interior of a Comet. First Comet 4 is expected to be rolled out next month.



ALL Comets will have Rolls-Royce and some show new and advanced thrust reversers, now approaching final development.

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design, it could be expected to speed development in some time 1/10 or per flight cycle.

Well-calculated exhaust and mechanical stresses have helped boost stress on contribution in these areas, de Havilland says. Preformed fatigue fittings in the vicinity of exhaust in said to have sustained explosion, decomposition of the fittings in the Comet which crashed.

Wing root stress levels have been reduced. For example, load flight 10g stresses through the and bulk heads of the front fuselage stress levels are down from 5.47 ton sq in. to the original Comet's 2.5 ton/sq in. as the current development.

The new type, which had to be considerably redesigned to accommodate the larger Rolls Royce Avon R.A.29 engines now has an integral web built into the solid which improves the fatigue strength over the fabricated web previously used. Introduction of anodized wing skin and stronger panels also contributes to improved wing fatigue life.

Fatigue Policy

Design policy was based on the achievement of a commercial life of 18,000 hr without the appearance of cracks. For the fighter, this life would involve 16,000 pressurizations. The test program aimed at achieving this by using the number of records without cracking.

Separate tests with the testing of areas, than 2,000 psi parts followed by cyclic pressurizing in a water tank of 100 psi, covering all the areas with certain where stress distribution was likely to be complex. Finally, three major portions of the fuselage were pressure loaded in the water tank. The wing root section, 26 ft forward portion of pressure cabin and center section involving the wing root.

All three sections withstood 115,000 pressurizations—equivalent to 104,000 flight hours—without major structural failure.

Loading on the center section as checked, post loads applied between 100 and 150 tons to the top wing spar beam attachments. Nearly three million post reversals were applied—equivalent to the cumulative effect of 104,000 flight hours.

In the static test program, a complete fatigue test was taken to destruction during a simulation of the combat loading condition. It withstood 104% of the full fatigue design load. Wings have been tested under loads five times the normal flight loads.

Fatigue testing of the wing structure was based on knowledge of the test spectrum experienced in service in the Mark 2 series. These aircraft carried specially developed, nonloading, stick-breaking equipment from which the test vehicle spectrum was obtained.

It was found that the most demanding post to Comet aircraft was one of +13 g's. The simulated loading at 12 inch gusts was considered equivalent to the cumulative effects of all the gusts experienced in a 4 hr flight.

Tests of two hour center section were conducted utilizing major structural failure. Tests consisted of 10 million cycles of +13 g's super imposed on 10 loading on one spar and nearly four million cycles of 17.5 g's on the other.

The loading was considered representative of a mean life of three million hours or a rate life using a scatter factor of five of 500,000 hr. Under similar loading, the two hour center section should have lasted 10,000 hr. A few months ago, tests on a complete wing were stopped after a safe life of 31,000 hr had been demonstrated.

Many of these tests were conducted on a 100-ton static fatigue machine specially developed for the test program. The machine now has been made generally available by the instrument company.

Reinforcing in stress levels have gauged fatigue life of cabin and wing structure, however, the aircraft is not the same as earlier Comets and is being produced along similar lines.

Roller loading of skin to struts, gives a close check on the work requires a full load on each and contributes to the reduction of a structure weight of only 48% of the gross weight. Roller loading was one of the outstanding structural features of the original design, as it represented a saving of 4% in structure weight compared with a conventional metal structure.

De Havilland would not discuss possible changes in the roller loading technique, and this part of the assembly area was "out of focus."

Comet Production

The only notable change in production shown to Armstrong Whitworth was change of wing to fuselage.

Wings are now joined to the center section before, instead of after, the center section is mated to the fuselage, a procedure which is said to speed assembly.

The Comet which is reentering a new sophisticated market, is considerably better up and 32,000 hr. longer than the Mark 2 series which last flew in 1959.

Engine testing has been proceeding on two Comet 2s, each fitted with two R.A.29 engines. These aircraft have been used by BOAC as route familiarization flights during the past six months.

The Rolls Royce Avon R.A.29 engines, a new test of the Ghost reengineering techniques which powered the 31-ft Comet 1 aircraft. These is a saving in specific fuel consumption on the order of 20%.

De Havilland proved the long life and fuel economy of the Avon engines, and called them the most developed and reliable aircraft engines in the world. A Rolls Royce spokesman told Armstrong Whitworth that the Avon is "at least 100% more than any comparable engine." This factor, together with experience gained from the Dart turbo-prop and turbine Avon, is expected to find in a 2,000 hr. overall life rate, which quickly Rolls Royce expects to get the engine started in the Comet at a 500 hr. rating and rise to 1,000 hr. within 12 months.

Modifications adopted in the civil version of the R.A.29 which have led to a 10% fuel economy gain include an additional compressor and turbine stage. Rated cruising consumption are 0.9 lb./hr. thrust/hr. at 50,000 ft. and 0.775 lb./hr. thrust/hr. at an load. Engine speed varies between 7,500 and 9,500 rpm.

Sales and Delivery

Orders for the Comet total 15, 39 international Comet 4s for Aeroflot, Canadian Airlines and an order for Comet 4Cs (AW No. 17, p. 47) for British European Airways. A world wide sales team coordinated last month was sent to Athens, de Havilland indicates.

Delivery to BOAC is planned for the second half of the year. The first aircraft will be used to complete the certification of the Mark 4 series, next of the pre-engineered and aerodynamic tests. However, already have been completed on a Mark 3 aircraft, a proto type aerodynamically similar to the Mark 4.

De Havilland lists the Mark 4 international Comet's capabilities as follows:

- Ability to operate the 2,000 to 1,000 mi. range length which the engine allows against the main centers of the world's traffic routes.
- Capacity provided with 76 tourist passengers in 79,360 lb.
- Adopting "crane-climb" technique, Mark 4 will maintain 500 mph. at 40,000 to 42,000 ft.
- Aircraft retains the 115 ft. wingspan of the earlier Mark 2 but has a larger fuselage—111 ft. 4 in. compared to 96 ft.
- The Mark 4B international version was equipped for short take-off and high speed—has 41 in. clipped off each outboard wing section. De Havilland lists the following capabilities for the Mark 4B:
 - Ability to cruise at 23,500 ft. over 200 to 1,550 mi. stages, where it achieves a higher air speed of 545 mph.
 - Fuselage length is increased to 138 ft.
 - Capacity payload is 23,000 lb. Air conditioning is provided for 84 first class passengers; freight. Range can be stretched to 2,000 mi. by adopting crane-climb technique.
 - De Havilland says, temporary offers a two-hour lead, better of 1975 and a cost per seat-mile of 1.6 cents at stage length increase. Even on a 210 mi. stage a 50% passenger load is enough to break even, de Havilland says.
- For the Comet on ground, de Havilland lists the following advantages:
 - Achievement of turbo-prop operational economy over other stages.
 - Short landing and take-off run due to modified wing loading.



Marines Get First FBU-1

First FBU-1 Canadian Air fighter recently was delivered by Chance Vought Aircraft to the U. S. Marine Corps Air Station at Beaufort, N. C., for assignment to VMF-122.

NEW AVIATION PRODUCTS



Lamp Ballasts

Thacoaircraft lamp ballast for aircraft lighting provides ballast-free constant light control over lighting tubes in series of 150 to 1, the same fixture inputs. Control equipment is 42 in. x 1/2 in. x 1/2 in. 400 cycles for full light output.

DeVid Products, Inc., 1133 Mission St., San Francisco, Calif.

Jet Blade Microscope

Turbine and compressor blade microscope is designed to allow checking not only sides of leading and trailing edges but also of bleeding of roots with blade finish. Image provided is a normal blade.



cross section that can be compared with a master during grinding in a holder that permits simultaneous viewing of both angles in the exposure.

Blades up to 24 in. wide and as long as desired can be checked with magnification of 40 times; special adapters are available to handle roots.

Engel Equipment Co., 411 So. Duane Ave. S., Chicago 5, Ill.

Small Actuator for Electra

Actuator that measures three inches long and weighs three-quarters of a pound in case is open and close in fact slams in point measured in feet through a subsequence system for ground cooling of Lockheed Electra's cabin.

Cost rate of the actuator is \$1,000.1 and it can supply up to 100 in.-lb. of torque, the manufacturer reports. Two stages of compressed planetary gears, arranged in a half inch deep case, permit fast high gear ratio. Ratio can be modified to 93:000.1 the motor shaft. Great motor has been checked.



and the actuator can stall at full open stroke, with voltage continuously applied without damage to the motor, it is noted. Motor is 145 x 1/2 inch plus, 400 cycle a.c. type with integral start up capacitor. Unit can be supplied with a 24 in. x 1/2 in. x 1/2 in.

AirResearch Manufacturing Division, Garrett Corp., Los Angeles, Calif.

Accelerometer Senses .01G

Operating on electrostatic principle, type 4-542 accelerometer is designed to sense dynamic shock values down to 0.01G from 25 cps. to 50 k.c., provides a flat response between 50 cps. and 60 k.c.

Unit will accurately measure values over acceleration and shock up to 1,000 Gs with damping and affected by 200Gs steady state acceleration according to the manufacturer. Device will operate at -114 to +140F. Low natural freq. of the equipment makes it suitable for testing small lightweight components, the maker points out.

Consolidated Electrodynamic Corp., 800 No. Santa Anita Ave., Pasadena, Calif.

Toolmakers' Microscope

Toolmakers' microscope with alter changeable objective and eyepiece lenses has magnification range of 27 times to 160 times; working stage is low table, permitting focus on workpiece up to 75 in. deep.



Manufacture is possible in two directions controlled by computer speeder reading directly to 0.0001 in. Unit's weight is 75 lb.

DeM Co., Des Plaines, Ill.

Small Drive Motors

Series of 50 by construction date in diameter motor line, specially apply either to drive instruments, control flow pumps or variable drives, manufacturing notes. First application of the series is a 1/2 in. diameter, 3/4 in. long.



17 or motor used in a pump in coffee-making machines in the Boeing 747 jet transport.

Electrical specifications include standard output a.c. power supply 400 cycle, 200 v.; 4 pole 4 phase continuous duty, 11,500 rpm. Motors meet with test specifications.

Trink Corp., 1009 E. Vermont Ave., Anaheim, Calif.

Pneumatic Jet Starter

Pneumatic ground starting unit is designed particularly to meet turbo, turbine engine requirements, but can be used as jet engine starting on jet turbine starter in jet or propeller start up.

Unit has enough tank capable of providing three successive starts in a 1.50



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The AiResearch unit shown above solves another critical electronic cooling problem in the following manner:

The larger fan, at top left of unit, draws cooling ambient air through the heat exchanger. Simultaneously, the smaller fan, at bottom center of unit, forced gas draws gas (air, oil or hydrogen) (G) through the heat exchanger and over the electronic equipment. The cooled gas maintains the cooled electronic equipment at the desired temperature.

The 39 by 24 inch hexacore mounting base for the cooling components is designed by AiResearch to form an integral part of the pressurized electronic equipment structure.

This cooling package, incorporating standard, proved components, was developed by AiResearch in minimum time. It and others are in liquid cooled units for similar purposes are based on almost 20 years of experience in the development of cooling systems for aircraft, missiles and nuclear applications.

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Read the complete story in Bulletin CEC-8011-X2

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As, is designed to operate at outputs of -10F to 130F, from sea level to 7,500 ft and relative humidity of 100%.

Compressor casing can build up pressure to strong leak from sealant is fully charged in 15 min; no pressure drops in the storage tank; compressor starts automatically to replace it. On charge, no pressure can be varied from 50 to 75 psi.

Base unit can be tank or tank mounted, Model 18AS 517131 and 18AS 517132, respectively.

PerPlate Industries Corp., 36706 Goffield Ave., Paramount, Calif.

Brushless Alternator

Brushless alternator with only one moving part being a solid-rotor rotor, is especially designed to operate at temperatures above 500F. Slip rings are chromalut (lead) machine is submersible explosion proof. Rotor speed is low, 1000 rpm. In centrifugal stress and by having vibration resistance for the condition test are included in the



Alternator package rather than a separate box.

Percent design ranges from 0.5 to 1.2 down to 175 kVA, but larger requirements can be met, the same factory reports.

Turbo-Machinery Division, Aerojet-General Corp., Azusa, Calif.

Light Shut-Off Valve

Alternator roller air shut-off valve, with schroeder, weighs 11 lb., has an inside diameter of 1.25 in. Designed Model 113, unit is a gas-tight, vented, open-ended butterfly type de-

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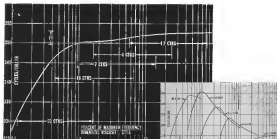
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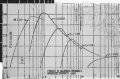
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signed to close off an flow with an accurate controlled an leak of 0.1 to 0.31 lb./min. with a maximum pressure drop of 4.71 psi.

Pressure drop across the valve does not exceed 0.43 psi for an inlet flow of 2.7 lb./min. at a pressure of 17 psi and temperature from -50° to 350° Fahrenheit. It is noted to be an on-and-off with an actuator air pressure of 65-90 psi.

Unit's length is 4 in., height is 2 in. and width, 1.52 in.
Ferguson Research Corp., 1940
Fountain Ave., Santa Monica, Calif.



Fast Plastic Sealer

Plastic coating machine in design to cover metal parts with bakelite protection, stripable material in one operation. Chemically heat-dipping coating material is rolled in an electrically heated, thermostatically controlled tank, a seven day program time delay control being included. Parts are hung on a conveyor belt transfer into the tank.

Aircraft Tools, Inc., 9030 Bellows Ave., Los Angeles 45, Calif.

Flight Data Plotter

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Hoffman solar energy converters turn rays of sunlight directly into electricity to charge batteries and to operate electrical and electronic equipment. A few of the amazing devices made practical by Hoffman solar energy converters are shown in the left. Some of these products are already on the market; others are undergoing intensive field test and evaluation. If you have applications for which Hoffman solar converters might be used to advantage, you are invited to write for additional information.

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WHAT'S NEW

Reports Available:

The following reports were sponsored by The Office of Technical Services, United States Department of Commerce, Washington 25, D.C.

Development of Metal-Bonding Adhesive with Improved Heat Resistance, by J. M. Black and R. L. Blount, Lamont Research Laboratories, U.S. Department of Agriculture, Inc. Night Air Development Center, U.S. Air Force, April, 1957. \$ 50. 30pp. (PB 121846)

Epoxycast Coating Systems for Aircraft Part I—Selection of Coating Resins, Study by S. H. Zimmerman and W. Behnken, Ohio State University Research Laboratories for Weight Air Development Center, U.S. Air Force, September, 1954. \$2.25. 65pp. (PB 121216)

Part 2—Accrual Penalty Methods and Solution, Caspary, Chemtreat, Inc. R. H. Zimmerman, September, 1954. \$4.00. 39pp. (PB 121214)

Fracture Deformation of Aluminum as a Function of Temperature, Stuenkel, Ruff and Gross, May 1957. \$ 7.00. 100 pp. (PB 121485)



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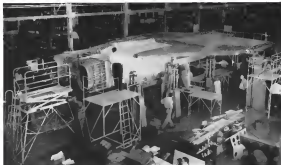
All view of the CF-105 shows the extreme thrust and short landing effort of the lifting and stabilizing surfaces. The first prototype has completed low speed tests at Malton Airport. Thrusts and will undergo high speed tests today in two or three weeks. During the high speed tests Arrow's chief test pilot, Jim Zentkowski, may take the aircraft up for its first flight but no data has been set. First line aircraft will be powered by Pratt & Whitney F73 engines, later ones by General Motors.

Avro's CF-105 Arrow, Nears First Flight

Pilot of CF-101 has tested vision (below). Close panels around his cockpit are still flat. Avro's speaker is some distance behind the pilot under an almost solid metal canopy. Very small windows on each side just aft of the engine in inlet give him his only view.



Broken-headed low-flight model of the Arrow is tested for flight. Thrusts such models were launched in Canada and the U.S. to supplement wind tunnel data. Solid fuel boosters lift Arrow after the model reaches speed data is relayed to the ground.



Center fuselage section is joined to the center wing panel and aft fuselage. As part of production testing which is being used in the construction of flight test aircraft. Several flight test Arrows will be built to speed this program.



Four center fuselage sections move down the CF-105 production line as one is being joined to a wing in the background.



Exclusive solid-state gauges in a free-flight model of the Arrow. Gauges accurate structural stress due to winds.



EADE-controlled RF771 platform down in clouds of fog pinned for flight in Army Electronic Forward Command (E-4) B-17s. Air Reconnaissance camera film into (center) Outlook.

Night Aerial Reconnaissance Unit Takes Rapid Series Flash Photos

New York-New, lightweight night aerial photo reconnaissance system (in armed plane or photon dome) has been developed by the U.S. Army Signal Corps and Fordham Camera and Testimonial Corp.

Heart of the system is a 174b KA-25, 45 x 45 in. mosaic image camera made in Finland. It is equipped with controls for huge Motion Compensation (MCC) to avoid blurring caused by taking pictures from low altitudes at high speed.

The KA-25 system has been installed in an RF771 drone made in Rudolphine Division, Northrup Aircraft, Inc.

To take night photographs, the film transport system of the camera selects a glowing window which opens, then with 14 film cartridges mounted on each side of the double Electrical system of power opens the cartridges.

A single 25 x battery supplies power to the entire KA-25 system.

Camera does not have a conventional shutter.

It makes a sequential series of pictures so that a strip of image can be photographed in a matter of seconds by an extremely rapid succession of flashes. Separate exposures on a continuously moving strip of film overlap each other.

Army engineers believe that the drone will prove to be almost impossible to intercept in short time because cartridges gate at some distance from the plane and hold them light very briefly.

The camera and mounting are built to absorb hard landing shock without damage.

Photoflash cartridge system was designed by the American Division, Universal Maltz Corp., St. Louis, Mo.

Long Range Planning and Research at Marquardt...



Roy E. Marquardt
President

Although market development in the Powerplants Division is the major activity here at Marquardt, there are three other divisions carrying on significant work: Controls and Accessories, Test, and Long Range Planning and Research.

The youngest of these divisions is Long Range Planning and Research. Headed by John Dicks, and numbering 30 engineers, the Division has two primary facilities.

PLANNING—anticipating product trends in areas where we are operating or might enter. Actually, this planning is done in a staff capacity, and normally the results end up as recommendations.

SUPPORT—to the other divisions, by anticipating product requirements which offer promise for the future. These improvements generally involve a small scale program to develop the idea as feasible. Then research facilities also may be concerned with areas which do not fit into present Marquardt projects.

Long Range Planning and Research was begun in 1954, one of its first studies concerned areas where the aircraft can be used or where it might be used in the foreseeable future. To date some exciting new government projects have been initiated. Some are variations of existing ones in existence, others are radically different.

Projects also have probed new "exotic" fuels, new types of drives, accessory systems, and controls. One phase of Aerojet's Model 3000-10 is now being explored.

Ground was broken near Newhall, California recently for a research test center. The aerodynamic facility will have testing capabilities to Mach 14.5 in a wind tunnel and Mach 14 free jet testing with constant conditions at full scale flight conditions (Hawthorne Research). In addition, it will permit simulation of supersonic conditions to Mach 6 and altitudes above 100,000 feet.

Within this Division, research engineers will find a spectrum of research engineering opportunities, including:

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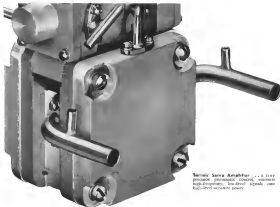


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Shown Here: John Dicks, Director of Long Range Planning and Research Division

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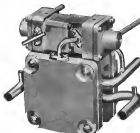
Memo: to missile men looking for dependable components

Tactair's proven servo amplifier is guided missile men to search when you recognize that today's servo and amplifier's muscles have greater functions and require similar controls. Often, a precision control developed for one has application for the other.

Case in point: the Tactair servo amplifier the "servo drive unit" of the revolutionary new Tactair T-1 Aircraft. The motor light weight and high accuracy of this tiny, completely unique unit give the aircraft superior flight characteristics. Tactair control, half the weight and cost of conventional types.

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Stock Transactions

Washington—Disposal of 27,900 Common Wright Corp. common shares by Roy T. Harker, officer and director, has been reported in the Securities and Exchange Commission, leaving a total holding of 11,500, with Harker's wife beneficially holding 100 common shares.

Other Corno-Wright transactions reported included: Disposal of 1,400 common shares by T. Richard Service, director, leaving a holding of 1,360; disposal of 1,000 common shares by Ind. O. Chubb, officer, leaving a holding of 1,000; disposal of 5,000 common shares by Thomas C. Carve, officer, leaving a holding of 5,000.

Disposal of 1,000 common shares by Nicholas DeMatra, officer, leaving a holding of 1,000; disposal of 400 common shares by William T. Lutz, officer, leaving a holding of 1,400; disposal of 1,000 common shares by Frank W. Menden, officer, leaving a holding of 1,000; acquisition of 1,000 and disposal of 2,000 common shares by S. B. Karmar Jr., for a holding of 6,100; acquisition of 1,000 and disposal of 1,000 common shares by Joseph V. Masco, officer, for a total holding of 5,000.

Other stock transactions reported by the SEC:

New York—Manufacturing Co. Inc. Acquisition of 100 common shares by Stuart A. Thompson, director, for a holding of 1,000 common shares; disposal of 1,000 common shares by Harry W. Merrill, director, for a holding of 1,000; acquisition of 1,000 common shares by William T. Lutz, officer, leaving a holding of 1,000; acquisition of 1,000 common shares by Joseph V. Masco, officer, for a total holding of 5,000.

Atlanta—Common Acquisition of 100 common shares by William T. Lutz, officer, leaving a holding of 1,000; acquisition of 1,000 common shares by Joseph V. Masco, officer, for a total holding of 5,000.

Chicago—Common Acquisition of 100 common shares by William T. Lutz, officer, leaving a holding of 1,000; acquisition of 1,000 common shares by Joseph V. Masco, officer, for a total holding of 5,000.

San Francisco—Common Acquisition of 100 common shares by William T. Lutz, officer, leaving a holding of 1,000; acquisition of 1,000 common shares by Joseph V. Masco, officer, for a total holding of 5,000.



F-104A Carries Test Boom

Lockheed F104A equipped with a 4 ft. instrument boom is shown being flight-tested by instrument. Aerojet is mounted through the joint at the boom and test and test and test by the T-400 collector. Nine large pylons test boom suspended on wings.

San Francisco—Common Acquisition of 100 common shares by William T. Lutz, officer, leaving a holding of 1,000; acquisition of 1,000 common shares by Joseph V. Masco, officer, for a total holding of 5,000.

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LOCKHEED Lodestar N 1245V, shown in flight, was out of control for several unknown causes during rapid descent during which structural failure occurred.

CAI Accident Investigation Report:

Loss of Control Probably Caused Crash

A Lockheed Lodestar model 35-36, N 1245V, owned by United States Steel Corp. and operated by its subsidiary Columbia-Greene Steel Co., crashed approximately 1 mi. north of Tyngs, Pa. about 1938 on Dec. 28, 1936. The captain, copilot and a company official, the only persons aboard, were killed and the aircraft was destroyed.

HISTORY OF THE FLIGHT

N 1245V departed Greater Pittsburgh Airport, Pittsburgh, Pa. at 1930 (Dec. 28, 1936) on an air flight plan via various V-15, V-6, V-108, V-10 and V-13 to New York International Airport, Terminal 8, Y. The crew consisted of Capt. Ray H. Hollis and Capt. Lewis Thomas Williams. Mr. Williams (headquarters of Columbia-Greene Steel Co.) was the sole passenger.

At the time of takeoff from Pittsburgh, the gross weight of the aircraft was 26,421 lb. (maximum allowable gross load 29,500 lb.) and the weight was properly distributed. The purpose of the flight was to transport Mr. Kauls to New York International Airport.

The flight reported to Pittsburgh Air Route Traffic Center at 1935 when it was over New Alexandria, Pa. (about 1,800 ft.). A second landing clearance to New York International Airport was issued to the flight at 1936 by ARTC in proceed via various V-15, V-6, V-108 and B-10 in climb, to be and maintain 9,000 ft. Accordingly, N 1245V reported turning 7,000 ft. and 5,000 ft. at 1937 and 1938, respectively.

Flight Data

At 1931 the Chief Aerodynamic Advisor, United States Steel Corp., at Philadelphia, Pa., received a call from the flight group at Pittsburgh as to the flight group at Pittsburgh.

At 1931 the Chief Aerodynamic Advisor, United States Steel Corp., at Philadelphia, Pa., received a call from the flight group at Pittsburgh as to the flight group at Pittsburgh.

At 1931 Philadelphia radio received a telephone call from a person 25 mi. east of the Columbia-Greene Steel Co. airport, stating that the aircraft was in the air. The person stated that the aircraft was in the air and was heading in the direction of Philadelphia. The person also stated that the aircraft was in the air and was heading in the direction of Philadelphia.

The Philadelphia 1935 radio received a telephone call from a person 25 mi. east of the Columbia-Greene Steel Co. airport, stating that the aircraft was in the air. The person stated that the aircraft was in the air and was heading in the direction of Philadelphia. The person also stated that the aircraft was in the air and was heading in the direction of Philadelphia.

The Philadelphia 1935 radio received a telephone call from a person 25 mi. east of the Columbia-Greene Steel Co. airport, stating that the aircraft was in the air. The person stated that the aircraft was in the air and was heading in the direction of Philadelphia. The person also stated that the aircraft was in the air and was heading in the direction of Philadelphia.

INVESTIGATION

The place of probable impact was in heavily wooded rugged terrain 1 mi. to the north of about 1,500 ft. The impact heading of the aircraft was probably caused by a structural failure of the aircraft. The aircraft was in the air and was heading in the direction of Philadelphia. The aircraft was in the air and was heading in the direction of Philadelphia.

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A detailed study of the wreckage indicated that the left wing and the engine failed about simultaneously. It was determined that the left horizontal stabilizer was the first component to fail.

was the first component to fail, as indicated by the left horizontal stabilizer. This latter component showed evidence of having been struck on its leading edge during the right-hand landing. The most likely striking object was the left engine before impact, which also appeared to fail.

Following the left wing and engine failure, portions of the engine's cowling and parts of the fuselage separated. These parts, both powerplant assemblies, fell out and the right wing was seen separated just before ground impact.

De-Ice Setting Unknown

It could not be established if the de-ice system components were in operation at the time of the accident, as the setting of the de-ice control panel to impact is unknown. Impact tests caused deformation and bending of the de-ice distributor valve rather than failure. It was found to be in good condition electrically and therefore it is believed to have been capable of operation before impact. Except for the damage sustained during the accident, the wing and cowling leading edge de-ice boots were in good condition.

The engines and propellers were removed from the crash area and transported to the engine manufacturers' plant at Culpeper, Va., for disassembly and more study. Both propellers were equipped with de-ice driving equipment. The positions of the propeller blades were: Left 45 deg., right 51 deg. All data were properly maintained. Study of the thin plate markings indicated that the propeller blades angles at impact were: Left propeller, 51 to 72 deg., right propeller, 45 to 54 deg. A complete examination of both engines disclosed no evidence of a failure of any of the essential components of the powerplants while in flight. It was observed that there was a visible shroud of deposits on the cowling.

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havior chambers of both types, each had a shield over available in entering members to cope with carbon arc and infrared rays. Top deck areas were applied on both carbon.

The aircraft was equipped with a dual set of instruments which included weather detectors, windmill, two inclinometers, altimeter and artificial horizon indicators. In addition there were instruments that were a magnetic compass, directional gyro, Collins Integrated Flight System and two automatic direction finders.

Radii Damaged

All radio communications and navigation equipment was extremely damaged by impact and fire. Some instruments were obtained from manufacturers of components of the Collins Integrated Flight System. The aircraft was hit by the enemy aircraft on a landing of approach 40 day. The landing gear was hit at approximately 40 day and the setting of the engine were approximately 74 day. The indicator (and all the main landing indicator was used at an approximate reading of 40 day. A compass setting could not be obtained from the remains of the main receiver.

Examination of the engine wreckage disclosed no evidence of major failure, and no clear evidence to indicate that a large object struck the aircraft in flight. All parts of the aircraft were accounted for within the wreckage distribution area. The main engine failure was not the result of fault in most of the design strength of the particular parts or components. There was no evidence which indicated that a fire or explosion occurred during flight.

An examination of the aircraft log books and maintenance records disclosed no pertinent discrepancies. Changes and maintenance records had been incorporated. The log also indicated that the aircraft had received

no scheduled 250, 300, and 1,000 h inspections. The aircraft had flown 92 h, 1,000 h, but 300 h inspection on Oct. 1, 1955 and 10 min since the last h inspection on the day of the accident.

On the afternoon of Dec. 30, 1955, an accident occurred near the outer edge of the runway, with the aircraft being from 100 to about 1,500 ft in the southbound portion with tops of approximately 11,000 to 12,000 ft. Fog and scattered light rain was occurring. At the time of the flight's departure the heading level was about 10,000 ft at Pittsburgh and lowering to the east to was 5,000 ft. In the front area, the aircraft was below the departure of N 121VV indicated light to moderate rain along shore the landing level, with the heading level being at 5,000 ft. An accident investigation was conducted at about 4,000 ft in eastern New York. Meteorological conditions were conducive to the formation of carbon arc indicators within wing.

Several Flights

There were several flights through the Pittsburgh area at the approximate time of the accident. They reported no rain or turbulence, however, their flight altitudes were below the 5,000 ft level at the time. Two of these flights mentioned a broken cloud condition a few miles east of Pittsburgh.

A number of witnesses to the accident was listed the aircraft. One witness located approximately two miles south of the crash heard the light engine at low altitude and then turn back toward the crash site. Two other persons, several miles southeast of the report, also heard the aircraft turn back. All witnesses told of hearing engine noises normally followed by engine failure. The person making the telephone call to the Pittsburgh CMA Communication Station at 1125 and the call was made about

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Airfield Vacuum Cleaner

Photo shows Cole Vac airfield vacuum cleaner in operation at Chicago Midway Airport. Another feature photo of airfield vacuum cleaner in operation at speed up to 25 mph, vacuum a swath 5 ft wide and neck up debris into one narrow square foot of runway in less than 10 seconds. Machine is powerful enough to pick up such items as bolts, nuts, ball bearings and rods. Lockheed and Boeing are currently operating Cole Vac at West Coast ports. Manufacturers is Cole Vac Division, Franklin Tools Co. Machine was originally designed by Coleman Engineering Co.



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It cannot. Unfortunately, the exposure of the fabric to the intense fire within the cockpit was diagnosed because of lack of control. It is the Bendix opinion that, had the loss of control which forced the aircraft to be ditched occurred at the very strength of the aircraft was due to unknown causes.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The loss and aircraft was correctly controlled.
2. The gross load of the aircraft was under the maximum allowable weight and properly distributed.
3. A severe instrument flight was made from Pittsburgh to the Philadelphia area.
4. Meteorological conditions at the aircraft's cruising altitude were conducive to the occurrence of turbulence or ice accumulation.
5. During an uncontrolled descent the aircraft failed structurally as a result of excessive airspeed.
6. There was no control or engine fire prior to ground impact.

PROBABLE CAUSE

The Board determines that the probable cause of the accident was the loss of control by severe turbulence resulting in a rapid descent during which structural failure occurred.

B. B. Civil Aeronautics Board
James R. Doolittle
Chief Counsel
Rear Admiral D. D. Denny
James J. Hester
(Member G. Joseph Smith did not take part in the adoption of this report.)

SUPPLEMENTAL DATA

The Civil Aeronautics Board was advised of this accident the night of Jan. 20, 1956. An investigation was immediately started in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

Aircraft Owner

The United States Steel Corp. has head quarters at 11 Broadway, New York City, and an office at Waterbury Canyon, Newport White Plant, N. Y. The subsidiary, Columbia Gasco Steel Co., has headquarters at 174 Montgomery St., San Francisco. This corporation and its subsidiaries operate numerous transport type aircraft based at various points in the United States. Four engine sections are operated under a system comparable to its sister practice with the jet-propelled turbo-propeller aircraft and provide flight training, ferry service, towing services. Maintenance of company aircraft is at its own level.

Flight Personnel

Capt. Ray B. Ball, age 45, held a first class pilot certificate with ratings in single, transport, multi-engine and type ratings on Lockheed P-3 and L-75. He was employed by the company as a pilot in 1945 as a pilot, and was transferred to Columbia Gasco Steel Co. on Aug. 21, 1951, as chief pilot. Capt. Ball had flown a total of 13,021 hr., of which 495 was in the Lockheed

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Lander. His last mission flight took him toward safely on Jan. 1, 1958. The date of his last flight was toward the June 5, 1958. His flying time, on the 30 days prior to Dec. 20, 1958, was 22 hr 30 min.

Pete Leroy Thomas Williams, age 47, held a currently effective action certificate, with ratings of commercial pilot, single and multi-engine land, and D.C.'s and Land, held 15 type ratings. He was employed by Columbia-General Steel Co. as a capital machine on Dec. 5, 1958. His last living time was 2,715 hr, of which 424 hr was in his type aircraft. His last flight of test was passed Jan. 30, 1958.

Lockheed, Lockheed, No. 1242V, model 10, the serial number 2478, was submitted, model Jan. 16, 1958. It was purchased from the Shreve-Piper Mill Co., Inc., Albany, La., on Jan. 1958. Total aircraft, from Nov. 5, 1958, with 2,715 hr, some single engine and 30 hrs since last test, was 10,000. The aircraft was equipped with two Wright "Rabbit" Corp. model 4000-100 in and one Hamilton Standard model 12500-115 propellers. Time on both engines since last overhaul was 424 hr, with the same amount on both propellers.

La Nica Plans to Buy Two Viscount 770Ds

Managua, Nicaragua—Luisa Acosta de Nicaragua plans to purchase two Viscount 770Ds. Orders for the two aircraft have not yet been placed, the airline hopes to have its Viscounts in service early this year.

La Nica expects to use the turboprops on routes from Managua to Pinar, Alvarado and Miami. Initially, flights from La Nica will be the planes.

Meanwhile, La Nica also plans to expand its present service to Central America to include San Jose, Costa Rica, using its present fleet of DC-3s and C-46s. The government has entered into a reciprocal agreement with Costa Rica and Luisa Acosta, Costa Rica's flag carrier, has entered its Central American to Managua.

Nicaragua has also entered into a reciprocal agreement with Peru and will serve to Managua from Lima. It is planned to start Jan. 25 in Lima, Peru, using a DC-3. The Peruvian airline, is an equipment exchange agreement with TWA Airlines of Honduras will operate from Lima. Nicaragua, Nicaragua, Tegucigalpa. This date is March.

TACA International Airlines, the flag line of the Republic of El Salvador, although it is owned, will place Viscounts in service on its Central American routes. Initial Viscount service, company officials state, will be between El Salvador, Guatemala and Mexico City and between Salvador, Guatemala and New Orleans.

TACA also expects to have Viscounts in service early this year.

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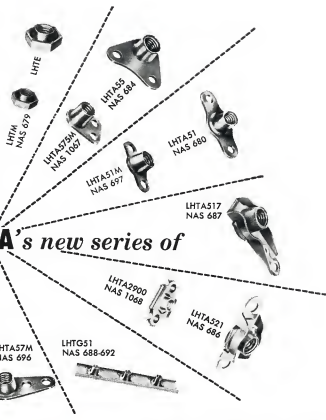
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